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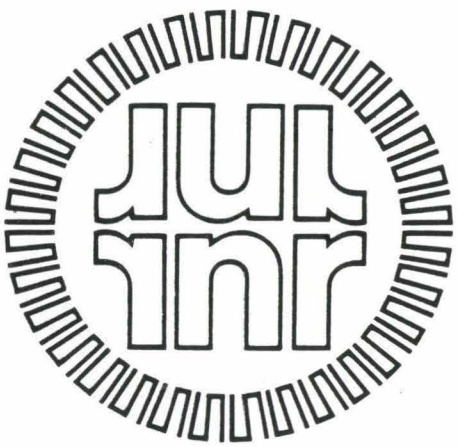
PUBLIC SUPPORT FOR FIRE MANAGEMENT POLICIES IN RECREATIONAL LAND MANAGEMENT



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PUBLIC SUPPORT FOR FIRE MANAGEMENT POLICIES IN RECREATIONAL LAND MANAGEMENT

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PUBLIC SUPPORT FOR FIRE MANAGEMENT POLICIES IN RECREATIONAL LAND MANAGEMENT

INTRODUCTION

Forest fire has long been prominent in American litanies of absolute evils to be unquestionably suppressed at almost any cost. Few publicity efforts have rivaled the scope and effectiveness of campaigns depicting the horrors of wildfire and featuring Smokey the Bear remonstrating the American public with his familiar refrain: "Only you can prevent forest fires!" Yet, by the mid-1970's a change in thinking about forest fires had occurred in the Forest Service, National Park Service, and other forest management agencies. "Fire management" had begun to supplant "fire control" in the lexicon of the professional forester (Lotan 1979; Kilgore 1976; Baeza 1981). Not that forest fires had suddenly been deemed "good". Not quite. Rather, forestry agencies' fire programs now increasingly recognize the ecological importance of fire and the potential benefits to be derived from using it as a forest management tool (Nelson 1979). Benefits such as the clearing of forest debris to reduce the occurrence of high intensity fire, improved water yields, improved grasslands for grazing, the control of certain tree pathogens, and the reestablishment of a natural vegetation mosaic more favorable to wildlife, have been identified (Richter and Ralston 1982; Sando 1978; Reeves 1977; Pyne 1982; Wright and Bailey 1982).

There have always been individuals within the forestry profession who believed naturally caused fires could be beneficial and questioned why some of these fires were not permitted to run their natural courses. Some even argued that under certain prescribed conditions fire could be deliberately set with beneficial results. But, until at least the mid-1960s, advocates

of beneficial fire were often dismissed by professional peers and an inculcated public as irresponsible enemies of nature and the public good (Schiff 1962).

In Arizona, for example, opposition was never stronger than in 1956 when an experimental brush fire set by University of Arizona range management personnel spread out of control and burned several thousand acres of the Prescott National Forest. The incident received a great deal of adverse publicity from the state's major newspapers and strengthened public and professional opposition to prescribed fire (Avery 1956; Arizona Republic 1956a, b, c, d). In retrospect, officials believe the incident may have set back the acceptance of prescribed fire in Arizona by at least a decade (Gunzel 1979; Shupe 1979).

But persistence, logic, evidence, and time have since had their effect on the forest management establishment, and formerly counterintuitive notions of good fires have been incorporated into federal forest management policies, albeit on a limited basis and amidst a strong remnant of skepticism. While the evolution of the new philosophy and science of fire management has done much to change the management direction and practices of land management agencies and land managers, there are limited data and information about public response to new fire management objectives and techniques. Many studies about public attitudes and fire reflect personal views and are not based on systematic and objective measures. Hall (1972), for example, speculated that if there is one dominant attitude held by the public it is that fire in forests is bad. Many, he indicated, probably have no attitude toward fire. Both Hall and Glascock (1972) felt that only a few rural populations—predominantly farmers—and certain scientific and special interest groups believe that fire can be good.

The success that fire prevention messages have had in convincing the public of the dangers of wildfire is also perceived as a major barrier to acceptance of new fire management programs (Glascock 1972; Schiff 1962). The U.S. Forest Service Smokey the Bear program has, for example, been a highly successful fire prevention campaign and has certainly raised the public awareness of the potential destruction of wildfires.

A 1968 survey (Haug Associates, Inc., 1968), comparing groups of children, teenagers and adults, showed that awareness of Smokey was high—among children Smokey was almost unanimously recognized and was clearly a favorite symbol. All test groups were conscious of human carelessness as a major cause of fire. Thus, with public awareness and acceptance of Smokey's fire prevention messages at such high levels, it is not surprising that another early survey would also find that fire suppression practices received virtually unanimous support among wilderness users (Hendee et al., 1968).

However, with the heightened level of interest within the scientific community toward fire management during the past dozen years and with increased public concern over issues of environmental quality and ecosystem integrity, it would not be unjust to hypothesize that findings such as those set forth by Hall, Glascock, and Hendee no longer accurately characterize public attitudes.

In recent years, three studies of public attitudes have systematically focused on fire knowledge and wilderness, national forest, and park visitors' attitudes toward fire management practices. Stankey (1976), for example, surveyed wilderness visitors to determine their knowledge about the role of fire in ecosystems and their attitudes toward wilderness fire suppression policies. He found that most users had a fairly low understanding about the role of fire in forests. Age, membership in conserva-

tion organizations, and previous wilderness experience had little correlation with support for liberalized fire suppression policies. There was, however, a stronger association between the user's knowledge about the role of fire and his support for new policies. While the majority of users favored suppression, a substantial minority did support a more natural role for fire.

Rauw (1980) examined the attitudes of national park visitors and neighboring populations at Olympic National Park. While he found that both visitors and residents were aware that certain fires are beneficial, at least "sixty-five percent... felt that all forest fires should be controlled at any cost" (p. 230). The public made no link between its knowledge about the positive role of fire in ecosystems and the possibility of managing natural fires in the park to achieve beneficial effects. Testing of public educational materials before selected park visitors, however, did show promise for increasing public knowledge of fire and support for future park fire policies. Like Stankey's study, Rauw underscores the importance of increasing fire knowledge as a way of building public support for implementation of new fire management policies and programs.

More recently, Taylor and Daniel (1982) tested public perception of scenic quality and recreational acceptability of both severe fire (wildfire) and light (prescribed) fire areas of southwestern ponderosa pine. In that study, public fire-effects information brochures were administered and tested for their effectiveness in changing respondents' general knowledge of fire effects, their attitudes toward fire management practices, and their perceptions of scenic and recreational quality of burn areas. A post-test was administered, subsequent to reading information

brochures and rating scenes for scenic quality and recreational acceptability, to determine fire-effects knowledge and attitudes toward fire management policies on the part of respondents. Since the Taylor and Daniel study and the study reported herein were conducted of the same population (Tucson residents), by the same institution (University of Arizona), and for the same agency (USDA Forest Service, Eisenhower Consortium), it was felt appropriate to utilize the same fire-effects knowledge and fire attitude on tolerance questions in both contexts. To cross check survey results, Taylor and Daniel ran a "no information" subsample wherein filling out the questionnaire was the first activity undertaken. A correlation coefficient was calculated between the mean responses to 12 quantitative questions (7 fire-knowledge and 5 fire-attitude) by the "no information" subsample and by the telephone survey audience of this study. This calculation showed a high correlation between respondents randomly contacted by phone and respondents in a convenience sample, group situation (a church group).

Taylor and Daniel's results show that fire effects significantly influence both perceived scenic quality and recreational acceptability of forest areas. Severe wildfire detracts from scenic quality in ponderosa forests, while prescribed fire can enhance scenic beauty following an initial year of recovery. Recreational acceptability was found to be sensitive to the type of recreation activity considered. Most pertinent to the objectives of the present study were the results of the fire-effects information treatments of Taylor and Daniel's study: reading short (six-page) brochures on the effects of fire on vegetation, wildlife, watersheds and air quality significantly increased respondents' knowledge of the effects of fire, as well as respondents' general tolerance of fire in ponderosa forests. However, these changes in knowledge and attitude show

no meaningful correlation to perceptions of scenic beauty or recreational acceptability. As with Stankey's and Rauw's studies, Taylor and Daniel have shown that greater public support for new fire management policies can be gained through increasing public knowledge of fire effects, but these changes do not imply that the burn areas will be perceived differently in terms of either scenic quality or recreational acceptability.

Stankey's study focused on wilderness areas and the users of wilderness. Rauw questioned national park visitors, and although he included nearby residents in his design, his sample was drawn from a list of businesses and municipal service organizations. Neither study was directed toward general public knowledge of fire and attitudes regarding fire management practices. Taylor and Daniel focused on the effects of providing information on public knowledge and attitudes rather than on broad-scale surveying of existing fire knowledge and attitudes. Finally, none of these studies focused on fire management in developed and intensely used recreational areas near urban areas.

This report builds upon these fire attitude studies by examining the question of general public support for changing fire management practices on public recreational lands near large urban areas.

The specific study objectives are to (1) describe the history of wildland fire policies associated with recreation land management by two federal agencies near Tucson, Arizona, (2) determine the level of public knowledge regarding fire, fire ecology, and management policies, and (3) develop recommendations as to methodologies land managers can use to improve public knowledge about fire management.

The urban population area of Tucson, Arizona, was selected as a study site because of its close proximity to recreational lands administered by

two separate federal agencies, the U.S. Forest Service (FS) and the National Park Service (NPS), each with its own fire management policy. A major portion of the mountainous forest and park lands partially rimming the Tucson valley--and favored by its 1/2 million residents for recreation--is administered by NPS's Rincon Mountain District of the Saguaro National Monument (SNM) and the Santa Catalina Ranger District of the Coronado National Forest (CNF). The SNM in 1971 and the CNF in 1978 adopted new fire programs which included the use of prescribed and natural fires as forest management practices. While experience with the new programs has thus far been successful in that they have not provoked any significant adverse response from the general public, the programs nevertheless are still on trial within professional ranks (Simmons 1981). Despite their present low public visibility, the continued success and eventual expansion of the programs will hinge not only on professional judgment but also upon any public response that might arise.

To meet the first study objective, the origins and evolution of the new agency programs were traced with respect to their effects upon and response by the general public. Local newspaper files and personal meetings with both Forest Service and National Park Service personnel provided valuable information on fire publicity in local news media, past and current fire policies, and public education programs. After describing and analyzing the meaning of significant events for this policy evolution and of agency approaches to fulfilling responsibilities of public accountability, a basis was provided for assessing the character of actual and potential public attitudes toward the new policies. To achieve the study's second objective and determine the level of public knowledge about fire effects and the nature of public support for fire management practices, a telephone survey of 1200 randomly selected adults in the Tucson area was

conducted during a two week period in late February and early March 1981. The results of this survey comprise a large portion of this report and form the basis for recommendations made as to the kinds of programs managers can use to improve public knowledge about fire management in public recreational lands.

FIRE SUPPRESSION TO FIRE MANAGEMENT

Fire Policies on the Saguaro National Monument and the Catalina Ranger District

A fire program permitting natural fires—usually lightning caused—to burn freely on a strictly defined basis was first adopted by the SNM in 1971 in order "to reestablish natural fire as a significant factor in the natural ecosystem" (U.S. Department of the Interior 1971). Under this basic fire management plan, all man-caused fires are suppressed without exception, as are all natural fires except for about ten weeks during the summer when the rainy season is well established (U.S. Department of the Interior 1975). The intent of the prescribed conditions are such that the fires are of low intensity and easily contained by natural conditions of moisture, terrain, and vegetation. The criteria for allowing certain fires to burn (i.e., the prescription) were developed largely on the basis of an analysis of climatological data and the fire records of the SNM, indices of the National Fire Danger Rating System, and the Fire Control Policy of the National Park Service. By most standards, the prescription is very conservative. However, the SNM plan admits, "[t] he potential for escape is always present" (U.S. Department of the Interior 1975). Deliberately set fires are not currently included in the SNM's program, but they are used by the CNF.

To an important extent, a motive for the conservativeness of the prescription was not entirely a matter of scientific soundness, but also largely a desire to reassure the public and attract CNF officials to the program. The CNF and the SNM share a common boundary of about twenty-nine miles, and for seven years without a common fire program the SNM faced strong limitations on fully implementing its new fire policy. The change in CNF policy formally came with the approval of its Rincon Mountain

Prescribed Natural Fire Plan in April 1978 (Hassell 1978). In January, 1979, the two agencies reached an agreement outlining several areas of cooperation in an overall plan of action for managing and controlling fires occurring at or near their common boundary. As part of this agreement, the two jurisdictions adopted a common plan for natural prescribed fires (USDA Forest Service and U.S. Department of the Interior 1979).

Evolution Toward a New Fire Policy for the SNM

Prior to the recent adoption of the new fire management plan, the SNM and the CNF adhered to a policy of total suppression of all fires, both natural and man-caused. Under the Forest Service's 10 AM Policy, fires were attacked immediately after they were detected in a manner analogous to an all-out military operation. First outlined by Forest Service Chief F. A. Wilcox in 1935, the 10 AM Policy, as enunciated in the 1977 Forest Service Manual, declared that:

> Fire suppression will be fast, energetic, thorough, and conducted with a high degree of regard for personal safety...(The fire organization will) organize and activate sufficient strength to control every fire within the first work period. If the fire is not controlled in the first work period, the attack each day will be planned and executed to obtain control before 10 o'clock the next morning.

Although the Park Service did not formally adopt a 10 AM Policy in its directives, many park superintendents unofficially adhered to its provisions (Baker 1975). With the exception of a few dissidents, this policy was widely accepted as correct within scientific and professional management circles, as well as by the public.

Among the dissidents was Les Gunzel, Chief Ranger of the SNM since 1956 and principal architect of the fire plan presently in effect in the Tucson area. In an interview conducted prior to his retirement in April, 1979, Gunzel recollected that there has always been some feeling in the

National Park Service, and among other forestry professionals, that fire should be allowed to burn in natural areas:

> As long as I've been around we have always asked why we put all the fires out. The answer we got was that the public wanted a good green scene, not a burned black scene. But it wasn't recognized that it was green because of a continuation of nature which included fires. We just happened to come in when a particular place was green and said it was either that way or it was black. There were some scientific people, as well as myself, who questioned this. We felt it was better to let some fires burn than use bulldozers or cut big lines. Those damages are really greater. Some of us began to dissent (Gunzel 1979).

For Gunzel, an important motive for dissension was the integrity of the Park Service's dual mission to maintain natural areas on the one hand, and, on the other hand, to provide for the enjoyment and benefit of people. These missions are somewhat at odds, if not contradictory, and compromises will always have to be worked out; but for Gunzel and other like-minded Park Service and resource management professionals, a philosophy of protectionism had for too long been overemphasized to the detriment of nature. Putting out all natural fires to preserve a natural area is not preservation of nature, it is the imposition of someone's preconception of what nature should be like. On the other hand, Gunzel recalls, there were people who wanted to reintroduce fire too quickly and "get back to nature in one fell swoop." This approach was also avoided by the SNM in establishing its natural fire policy (Gunzel 1979).

A particularly significant course of events, both in Gunzel's experience and in promoting a change in National Park Service policy, transpired at Yellowstone National Park from the mid-1950's to the early 1960's during Gunzel's assignment as a fire control scientist at that Park. As Gunzel tells it, the boundaries of Yellowstone had been established mainly on the basis of including all the geysers and thermal valleys without much attention paid to wildlife. But there were herds of elk, particu-

larly at the north end of the Park, which regularly migrated from the Park through the Yellowstone Valley to winter in the plains area. But as people moved into the Valley, the elk's migration route was disturbed by development and heavy hunting pressures at the Park's boundary. Consequently, the elk began to stay within the Park and serious overgrazing problems soon appeared. The Park Service tried unsuccessfully to reduce the herd through trapping and relocation, and as a last resort began to thin the herd by shooting the animals. By this time the area outside the Park had developed into a major elk hunting center and Park Service policy developed into a major local political issue. In 1963 Secretary of the Interior Stewart Udall appointed a blue-ribbon Advisory Board on Wildlife Management, chaired by A. Starker Leopold, to study the Service's wildlife management program in several western national parks. The committee studied a wide range of complex interrelated factors influencing the entire biological community and issued a final report in 1963. It concluded that adverse ecological impacts were occurring in park ecosystems as a result of fire exclusion. Suppression of fire was seen as a contributing factor to overgrazing, and at Yellowstone, had permitted the range to convert to forest. The committee recommended that research be undertaken to devise methods to allow fire and all other natural factors to become re-established in the environment (Leopold et al. 1963).

After reviewing the Advisory Board report, the National Park Service began seriously to consider altering its policies in order to permit natural conditions to "be reestablished as nearly as possible in the condition to which they would have evolved if man had not interfered" (U.S. Department of the Interior 1971). In 1968 the National Park Service Director decided to allow fires to burn under certain circumstances within national parks, and several parks began to implement new fire management

programs, the Saguaro National Monument among them (Baker 1975). Between the declaration of the Advisory Board's objective to return fire to park ecosystems and the establishment of the NPS's natural fire program at Saguaro National Monument, eight years had passed. According to Gunzel this interim period was crucial for reorienting both professionals and the public to the new policy:

> The lag time between '63 and adoption in '71 was good. We needed it to avoid the extremes. And also, we had all been trained for so long that fire was absolutely bad. We faced a challenge to use our expertise to allow fire to be re-introduced in a manner acceptable to the public and to the resource...We had to have a moderate and reasonable approach that the public could accept. We couldn't let all fires go...(Gunzel 1979).

During these eight years the idea of beneficial fire was introduced to the public through the local papers, educational efforts by conservation groups, and personal contact with the academic community at the University of Arizona. Once the plan for the SNM was drawn up, any potential for major public resistance had pretty well been ended. Anticipated resistance from ranchers did not materialize once they understood that fire would mean less brush and more grass. Ironically, with NPS's return to nature policy, grazing was eliminated from the SNM (Gunzel 1979).

Implementation Experience

The SNM's fire program was introduced in 1971 under the rubric "natural prescribed fire program" (Department of the Interior 1975). The Monument was chosen as the site for one of NPS's early attempts into "fire management" because of its fire history, biotic diversity, climate and, undoubtedly, the presence of Les Gunzel. The original plan provided that all natural fires will be controlled and extinguished except those occurring under the following conditions: the fire occurs after July 1, the summer monsoon rain pattern is fully established, total rainfall since June

15 at Manning Camp exceeds 2 inches, and the National Fire Danger Rating System (NFDRS) Buildup Index does not exceed 40 nor the Spread Index 30 at Manning Camp. Later refinements in the NFDRS components and indices allowed the SNM to further define spread and energy release components and burning index values for specific fuel models and several additional monument locations. When all these criteria were met, any natural fires were evaluated for "let burn" status if no cultural resources or physical facilities were threatened. Those fires allowed to burn were closely monitored and suppression action taken if any danger became apparent. In keeping with a sensitivity to public acceptability for a new fire policy, an effort was made to introduce the plan through the pages of two local newspapers about one year before beginning implementation. Good cooperation was obtained from both papers and proved helpful in conveying to the public the idea of fire as a positive factor in the environment. Neither of the newspapermen who wrote about the program could recall receiving any adverse comments, nor in fact could they recall any public response at all to their columns and articles (Gunzel 1979; Cowgill 1979a, b; Stiles 1979). By all indications, the Prescott incident had long since faded from public memory and public attention to the program was low.

Ordinarily, such a significant change in policy would now be subject to the environmental impact statement process in accordance with the National Environmental Policy Act of 1969 (NEPA). Through the process of public and interagency review mandated by NEPA a record of comments and responses to the environmental impact of the new plan would have been established. However, in 1970, NEPA had been in effect for only a few months and most federal agencies were uncertain how to respond to it. SNM was uncertain whether or not NEPA applied to their plan but nevertheless, on the basis of an environmental assessment, SNM decided that preparation

of an environmental impact statement was unnecessary. Although a formal opportunity for public involvement in the plan was thereby foreclosed, permittees, academics, and a few conservation and outdoor groups were consulted. The assessment document was forwarded to the Regional Office and little more was thought of it for the next few years. Finally, the Regional Office decided to write a statement covering all the new fire management programs in the region, and in 1975 another environmental assessment was prepared by the SNM. Again, a "negative declaration" of the need for an impact statement was pronounced. Nevertheless, the Regional Office proceeded with preparing its statement and public and agency involvement under NEPA was provided at that level rather than locally.

A second publicity effort was made through the local newspapers in 1971, and again no public response, adverse or otherwise, was received. Having passed this initial test of public acceptability, implementation of the plan began in the summer of 1971. The first year of the program saw only eleven small natural fires, of which all but one were allowed to burn and run their natural courses. Frequent rains contained the fires to very small areas. The largest fire burned only three acres, and in all only six acres were burned during the natural fire season. No public response was received as a result of this first season of experience (U.S. Department of the Interior 1979).

The most severe test for the new policy came with the 1972 season. From the standpoints of both the good of the resource and of public acceptability it was a crucial year. Following a second consecutive year of uncharacteristically low winter and spring rainfall, twenty-two fires occurred, ten of which began during the prescribed fire season and were permitted to burn naturally. However, in sharp contrast to the first season, and to every subsequent season, natural prescribed fires burned 896

acres (a figure accounting for 97.5% of all acreage burned by natural prescribed fires in the Rincon Mountain District during the eight years of the program) and fire was continuously present in the Rincon Mountains from the 16th of July to the 7th of September. The largest of these fires, the Four Corners Fire, burned 620 acres, but was not visible from the valley and remained unnoticed by the general public. More important for eliciting public response were the Helen's Dome fire (215 acres) and the Helen's Dome South fire (62 acres) which burned simultaneously at about 8200 feet on the west slope of Mica Mountain and were highly visible to Tucson valley residents (U.S. Department of the Interior 1979; Gunzel 1979).

The Helen's Dome fires precipitated an avalanche of telephone calls to the SNM, and several more mistakenly made to the CNF. Les Gunzel personally received most of the calls and remembers most callers as being initially indignant and "demanding the fire on **their** forest be put out."

Gunzel stated that he was successful in mollifying their anger by giving a careful explanation of the fire program and reassuring them that the SNM knew what it was doing. He recalled only one caller who remained sceptical; a woman who had served as a fire lookout in Idaho, and having seen a terribly destructive wildfire had retained an understandably strong fear of all forest fires (Gunzel 1979). Attempts to calm the public and explain the program were also made through the local newspapers (Cowgill 1972).

A second notable result of the 1972 season relevant to the public accountability features of the program involved the establishment of a relationship with the Pima County Air Pollution Control Department. Neither local nor state air quality agencies were alerted to the fires despite the fact that smoke did cause air pollution in populated areas in the eastern portion of the valley. According to Gunzel, this failure was

not an oversight, but was deliberately done for two reasons. First, he felt nature had an inherent right to reestablish itself without a government permit. Second, had a permit been requested and refused, the program would have been delayed and the opportunity to learn a great deal from these fires would have been lost. This tactic was pursued to achieve quick action from the air quality controllers in Pima County, and, in Gunzel's words: "we got it" (Gunzel 1979).

As might be expected, the Pima County and state air quality regulators were miffed at being deliberately ignored by the SNM, and a meeting of health, environmental, national forest, and national park officials was called in Phoenix. Complaints were aired by officials from the U.S. Environmental Protection Agency, the Pima County Health Department, and the State Division of Air Pollution Control, and explanations were made by SNM officials. An agreement was worked out whereby the SNM would formally contact the county health department at the start of each season and upon the detection of all fires that will be allowed to burn, and if air pollution levels in the valley are too high the SNM will comply with the health department requests to suppress the fires. Thus far this agreement has been carried out by the SNM, although no requests to suppress fires have yet been made by the health department. Since the summer of 1978, under the Clean Air Act amendment of 1977, the SNM and other federal agencies have been required to obtain permits from local and state air pollution agencies for pollutants produced on federal lands.

Following an uneventful third season in the summer of 1973 during which four fires were permitted to burn a little more than an acre without eliciting any public response, the Natural Prescribed Fire Program was judged a success on the SNM:

> No serious fire damage has been observed. A start has been made to allow the natural scene to become reestablished. At the present time it would appear the prescription is adequate. However, if more acreage does not burn in the next two or three years we may wish to allow fire to start and burn earlier in the season...(U.S. Department of the Interior 1979).

Despite the fact that only about sixteen acres were burned under the program over the following five years by fifteen natural prescribed fires, no basic change in the prescription was made. As Gunzel explained it, the conservative prescription was maintained for both scientific and political reasons (Gunzel 1979). First, the program was not expanded for climatological reasons. To extend the prescription into a drier part of the season, before the "monsoon" season is fully established, would run the risk of a high intensity fire that might extend beyond SNM's capability for control. The SNM fire control force had been reduced to conform to the new management emphasis on reestablishing nature, and while the capabilities exist for suppressing fires at an early stage, it was feared they may not prove adequate for stopping a high intensity fire that had been allowed to burn for some time. Furthermore, there is private land bordering the monument where expensive homes are located. If a fire was to get out of control and cause damage or destruction to property or personal injury the entire program would be in jeopardy. "We would be in danger of sacrificing our integrity and public trust" (Gunzel 1979).

Secondly, the extent of burning that could occur under the present prescription has not been approached. For example, if the two inches of rainfall at Manning Camp—the site at which precipitation measurements for the prescription are taken—were received very early in July, the lower elevations could still be left very dry and a substantial amount of acreage could burn. Additionally, the fact that grazing has been eliminated from

the Monument permits greater grass cover and a larger potential for a widespread fire at lower elevations.

Finally and, in Gunzel's view, most importantly, the program was not expanded because the CNF had not yet joined the program. Because the two agencies share a common boundary--about 29 miles--cooperation from the CNF was essential to fully obtain the benefits of the program and possible expansion in the future. Thus, the need was felt to set an example and demonstrate to the Forest Service that a responsible program could be implemented. If an accident had occurred, or if a fire had been allowed to burn that could have been in any way interpreted as damaging, cooperation from the Forest Service would have been interminably delayed. Only in 1978 was a prescribed natural fire plan approved for adoption by the CNF (Hassell 1978) and, as previously noted, a Memorandum of Understanding between the CNF and the SNM was concluded in January 1979.

As the CNF began to actively implement its prescribed fire plan, the SNM also realized that conditions were favorable for expanding and revising its own program. In light of new fire knowledge and experience, what had been considered innovative in 1971 was now viewed as too conservative and in need of change. However, ironically, as the CNF program moved forward, the SNM's efforts to liberalize its prescription lagged behind. Staff turnovers and reduced funding for unit operations slowed efforts to make changes in the fire prescription (Hall 1983). Nevertheless, in 1983, the SNM is submitting a new prescription for regional approval. If approved without substantial modification, the prescription and plan will allow man-caused fires to be evaluated for prescription suitability on an individual basis, introduce a new method for computing fire weather, and add a fire coordinating organization. A fire ecology study is also being made to identify and relate biotic communities to fire, ascertain fuel loads,

indicate long-term fire history and define wildlife benefits. This study will determine, for example, if there is a need to introduce planned ignitions within the Monument and will also serve as the basis for a revised and updated fire management plan (Hall 1983).

CNF's Adoption of a Prescribed Fire Policy

The CNF's prescribed natural fire policy for the Rincon Mountain area in the Santa Catalina Ranger District was officially put into effect in April 1978 as a field response to implementation of a major change in the agency's overall fire policy. While the Forest Service's new policy embraced the Park Service's goal of reintroducing fire as an integral part of the forest ecosystem, economic grounds served as the major rationale for the agency's policy change (Amicarella 1980). Both the SNM's Gunzel and the CNF's Fire Staff Officer at the time, Howard Shupe, reflected this difference in agency emphasis. Gunzel, for example, stressed the effects of the SNM's fire policy on restoring nature ("The real point is to achieve the desired environmental effects rather than to talk dollars and cents."), whereas, Shupe was more explicitly concerned with the effects of wasteful expenditures under a total suppression policy. A further difference in emphasis of the two agencies is also symbolically expressed in the SNM's designation of its program as "natural prescribed" and the CNF's designation of its program as "prescribed natural."

The Forest Service, according to Shupe, actually began making exceptions to the 10 AM Policy in the Tucson area around 1961. In Shupe's view, public response to the CNF's approach was good in that no public opposition surfaced. However, exceptions to the policy were done so cautiously and with such little publicity that it is doubtful the general public was even aware of the Forest's actions. This lack of public awareness is further

confirmed by the public's encouragement to the CNF to abandon the total suppression policy following publicity of the SNM policy change in 1971 (Cowgill 1979a). As Shupe recollected:

> The public wanted to know since we surround the Monument, why we maintained a policy of tapping out fires--especially to the extent of dropping slurry--and why we were spending so much money on fire suppression. We were kind of embarrassed because we didn't agree with a policy of total fire suppression (Shupe 1979).

But in 1971, the Forest Service nationally began to develop a more effective fire suppression force, although it did make one important concession to the 10 AM Policy by allowing approved, pre-planned exceptions (USDA Forest Service 1971). The next few years brought an increase in fires coupled with a 57 percent increase in average expenditures (Nelson 1979). In response to concerns over rising fire suppression costs, the agency began to ask questions about the costs and results of its fire management programs. The Office of Management and Budget also began to pose questions and requested the agency to prepare a detailed study of its fire management practices, procedures and management strategies (Gale 1977). As a result of the findings of this study and other top-level agency discussions, the agency's basic fire policy was changed in 1978. The policy delegated authority to the regional forester to establish and approve fire management areas and to use unplanned ignitions to meet management objectives. The policy also encouraged the use of planned prescribed fires within approved management areas. Fire management was also to be integrated into the agency's comprehensive land management planning process, which was established by the National Forest Management Act of 1976 (Nelson 1979; Davis 1979).

By June 1978 the CNF had developed a management document under the agency's new fire management policy which divided the Forest land into two

fire suppression areas and specified appropriate fire management activities for various fire danger levels in each area (U.S.D.A. Forest Service 1978). Prescribed natural fire plans were drawn up in the form of Environmental Analysis Reports for the Chiricahua Wilderness, Galiuro Mountains, and the Rincon Mountains. A fire plan for the Pusch Ridge Wilderness Area on the Santa Catalina Ranger District was implemented in December, 1980. With declarations of no significant adverse environmental impact, no environmental impact statements were prepared. But in keeping with the spirit of NEPA and the Forest Service Inform and Involve Program, public input to these plans was received from permittees and other government agencies. All comments were reported as positive (U.S.D.A. Forest Service 1977a, b, c).

An additional opportunity for public involvement was also afforded through the public participation program conducted in 1978 as part of the CNF's comprehensive land management planning process. Results of the involvement program indicated that fire policy was not a highly salient public issue, and to the extent that it was mentioned by the public, prescribed fires were supported. Only one substantive comment was recorded which opposed such fires: "I am opposed to controlled burning of the forests. Fuelwood gatherers should be allowed in the areas that need thinning. Burning is a waste of needed firewood and leaves such ugly scars for years" (Garcia 1978).

Nationally the first year of the Forest Service's new fire policy saw no real challenge, but in 1979 and 1980 events occurred which would lead to a review of the basic policy. Fire activity was high in 1979. Several fires received national attention, and the governor of Idaho publicly criticized the Forest Service for letting one large fire in the Selway-Bitterroot area burn (Montague 1979). In 1980, a prescribed fire that had

been deliberately set to prepare breeding grounds for the endangered Kirkland's warbler got out of control, killing a firefighter and destroying dozens of homes (New York Times 1980). These events prompted the Chief of the Forest Service to initiate a national review of the agency's fire policy (Leisz 1982; Amicarella 1980). While the review found the basic policy to be sound, it also concluded that there had been a significant lack of understanding of what it took to implement the policy at the local level. There were perceived communication problems within the Forest Service as well as with the public (Amicarella 1980). As a result, a number of policy changes were initiated to establish more centralized control over local fire management practices (Leisz 1982) and to ensure fire practices did not exceed knowledge or capabilities (Amicarella 1980). For example, more experienced personnel were required as part of the fire team, team responsibilities were more tightly defined, more specific contingency plans were required if fire behavior did not fall within the bounds of the prescription, monitoring plan requirements were strengthened, and more regional office involvement was outlined (Thomas 1983).

On the Coronado National Forest, the events of 1979 and 1980 delayed incorporation of some aspects (including planned burns) of the forest's fire program. However, as the Forest Service began to implement its revised policy, the CNF began to accelerate its use of prescribed fire (both planned and natural unplanned ignitions) as a management tool. In 1982, for example, several planned prescribed burns were approved by the regional fire officer. One of the largest took place at the north end of the Samaniego Ridge in the Santa Catalina Mountains (Cowgill 1982). These fires all received substantial television and newspaper coverage.

In 1982, the forest's draft land management plan (USDA Forest Service 1982) was also released for public comment. The plan proposes to divide

the forest into three management zones. Prescribed fire will be used as a tool to meet resource objectives in each area. In wilderness areas and zone 3 areas, lightning fires will be treated as prescribed fires. And while protection of life, property and resource values remains the top priority, the plan will enable the forest to seek additional opportunities to reduce the costs of suppressing wildfires and introduce more economic efficiency into fire budgeting and fire management activities (Schweitzer et al. 1982; USDA Forest Service 1980).

On the Santa Catalina Ranger District, planning is underway for implementing the land management plan's directives. Proposed changes in the SNM's prescription also present opportunities for change in the CNF's prescribed fire prescriptions in areas adjacent to the Monument (Thomas 1983). While the Forest Service would continue to suppress all man-caused ignitions, the CNF's and SNM's prescriptions would otherwise be nearly the same, an indication of the cooperation that currently exists between the two units in the development and implementation of their fire policies (Hall 1983; Thomas 1983). Success and further expansion of the two fire programs, of course, will depend not only on technical advancements and field experience, but also on public acceptance and understanding of the purposes, benefits and limits of fire as a management tool.

SAMPLING METHODOLOGY FOR FIRE SURVEY

The fire survey sample utilized for the study covered by this report consisted of 1,200 telephone listings selected by a random procedure from the Tucson section of the July 1980 telephone directory. The actual telephone interviews were established and supervised by an independent survey research consultant. The survey instrument, or questionnaire, was tested several times including a 50-sample telephone pre-test (Appendix A).

Random Samples

The random selection procedure consisted of three stages where a table of random numbers was used to select first 1,200 pages, then one of the four columns on each page, then one of the listings from the selected column. If a selected page or selected column turned out to be totally nonresidential listings, then a new random number was used to select a replacement page or replacement column.

In the final stage of selecting a listing from each selected column, when counting down the column to identify the random listing, each distinct listing was counted. By "distinct listing" is meant that multiple numbers listed for the same business or individual were counted as only one listing. All listings, whether they appeared to be residential or nonresidential, local or toll, were counted. If the listing identified by the random number turned out to be a nonresidential or toll number, however, a new random number was used to select a replacement listing from the column. So the final sample included only private residences and local numbers. The sample telephone numbers were written directly on the interview forms before they were assigned to interviewers.

The rules governing when and how an interviewer could substitute a new phone number for a sample number when it was not possible to get a completed interview at the number assigned are given below:

- A substitution was made immediately whenever:

    1. The number had been disconnected or was not a working number or had been changed.
    2. There was no one living in the household who was 18 or older.
    3. No one in the household spoke English well enough to conduct the interview.
    4. A refusal was obtained which was thought to be irreversible.

- A substitution was not made but attempts were continued to try to get an interview at the number (until later in the survey period) in the following situations:

    1. A busy signal was obtained or no answer at the number.
    2. Someone was too busy at the moment, but was willing to respond at a later time.
    3. A refusal was obtained which was thought possible to be changed later.

- If a phone number turned out to be anything other than a private residence, the interviewer was instructed to call the survey supervisor for a new original number.

Substitution Procedure

When a substitution had to be made, a random procedure was used to ensure that the sample would remain on a statistically sound basis. This procedure consisted of forming a new telephone number by selecting a new last digit from a table of random numbers. If the new number did not generate an immediate response a second number was formed by again randomly changing the last digit. If all numbers from 0 through 9 where used without a response, the same procedure was then followed with the second to last digit.

Sex Distribution in the Sample

Each interviewer was required to take half of his or her interviews with men and half with women. Since men answered the telephone less frequently than women, interviewers were encouraged to ask if a man was available when a woman answered the telephone. However, since the first priority was to get an interview at each telephone number, the interviewer requested a man only if a cordial reception had been received. The chances of obtaining a male respondent were increased with calls in the evening or on weekends.

RESULTS

Socioeconomic Profile of Survey Respondents

At the conclusion of the interview, the respondent was asked several questions regarding residence status, age, education, income, and sex. These socioeconomic data are presented in Table 1.

The data in Table 1 indicate that the 1200 respondents to the fire survey represent a broad sample of Tucson's general populace. Although the age distribution of the respondents less than 30 years old, between 31 and 50 years and over 51 years of age is nearly the same, 82% of them have resided either less than 5 years in Tucson or over 11 years. As antici-

Table 1. Distribution of survey respondents by socioeconomic categories.

Years living in Tucson	5 or less	6-10	11 plus	N[1]		
	400	216	584	1200		
Age in Years	30 or less	31-50	51 plus	N		
	412	378	410	1200		
Education[2]	HS Grad	Some Col	Col Grad	N		
	433	388	368	1189		
Annual Total Family Income in 1,000's (K's)	Under 5K	5-15K	15-25K	25-50K	50K+	N
	78	276	361	267	62	1044
Sex	Male	Female	N			
	605	594	1199			

[1] Differences in sample size from one variable to another are due to nonresponses.

[2] HS Grad = less than high school (140) plus high school graduates (293); Some Col = some college, trade or business school beyond high school; Col Grad = college graduate.

pated, a cross-tabulation of these two variables shows that 244 (20.3%) of the respondents over 51 years of age also have lived in Tucson over 11 years, while 185 (15.4%) of those 30 years old or younger were Tucson residents less than 5 years. It is of interest to note that 162 (13.5%) and 178 (14.8%) of the respondents that have lived in Tucson over 11 years were in the less than 30-year and in the 31- to 50-year age groups respectively.

Thus, the residency and age profile suggests that a substantial number of respondents have been in Tucson long enough to have perceived any changes in fire policy and management of nearby federal lands. These respondents also represent a broad continuum of ages which would indicate a good sample of native-born Tucsonans and out-of-state immigrants.

The educational level of the respondents is high with 368 (30.9%) possessing college degrees and an additional 388 (32.6%) having post-secondary training. If a future program to educate the public on the potential advantages of prescribed burning is being contemplated, the high educational level indicated by this sample of respondents would imply the possibility of a better understanding of scientific resource management by the general public and more acceptance of any fire policy changes.

The distribution of males and females in the survey was nearly ideal with 605 (50.4%) males and 594 (49.5%) females interviewed. However, further analysis of additional variables with sex show some departures from the norm. For example, if cross-tabulated with age the number of males and females under 30 years old is 236 (19.7%) and 176 (14.7%) respectively; between 31 and 50 years of age, 188 (15.7%) males and 190 (15.8%) females; and over 51 years old, 181 (15.1%) males and 228 (19.0%) females. These figures indicate that the younger respondents tended to be men while the older were more likely to be women. In terms of education, 435 (36.6%) of

the female respondents had a high school diploma and some college experience while 386 (32.5%) of the males had similar status. However, an additional 214 (18.0%) males reported the completion of a college degree, while females with college degrees numbered 153 (12.9%). Total family income data indicate that women number slightly higher in the income brackets less than $25,000, 381 (36.5%), as compared to 334 (32.0%) men. For incomes of $25,000 or over per year, men exceeded women by 194 (18.6%) to 134 (12.8%). Approximately two-thirds (690 or 66.1%) of the respondents indicated a total family income of $15,000 or greater per year. However, caution should be used in interpreting income data because of the possibility that more than one wage earner is contributing to the total family income.

This socioeconomic profile of the fire survey respondents indicates that the random survey did indeed sample a wide cross-section of the Tucson metropolitan population.

Survey Results and Analysis of Responses

In designing the survey instrument (Appendix A) an attempt was made to determine initially the respondent's level of knowledge and concern about forest resources and his or her perception of and concern for forest fires. Then, following some statements that served to educate the respondent on items such as differences in forest fire intensity and possible beneficial effects of fire, questions were asked which attempted to evaluate the receptiveness of the individual to this new information. The actual telephone time for conducting the complete questionnaire varied from 12 to 25 minutes.

To report fully the results of the survey, each question will be considered and discussed individually. Attention, in particular, will be directed to the distribution of responses and to any significant differ-

ences detected in cross-tabulating the question with socioeconomic factors. Pearson's Chi Square statistic was used to test the independence of the cross-tabulations at a 5% probability level.

Question 1.

The opening question of the telephone survey asked respondents how important they thought forest areas were in comparison to other resources. To make the survey and the question more relevant, forest areas were defined by the interviewer as areas similar to those found at the higher elevations of the Santa Catalina Mountains near Tucson or the White Mountain area on the Mogollon Plateau in east-central Arizona.

The distribution of responses on this question are presented in Table 2. An overwhelming percentage of the respondents felt that forest areas were, indeed, very important resources. It is quite apparent that Tucson residents place a very high value on forests.

To analyze further the distribution of these responses, a breakdown by socioeconomic categories was made (Table 3). The responses are quite consistent for each category and also among categories. The total percent of respondents who indicated that forest areas were very important or somewhat important ranged from 94% to 99%. The greatest variation occurred in the level of education category, particularly between the high school graduates and those having some post-secondary education or a college degree.

With such a large percentage of the sample population placing a high degree of importance on forest areas, it would suggest that any management activity or policy decision concerning forested areas would be subjected to a considerable amount of public interest and scrutiny.

Table 2. Number and percent of respondents who thought that forest areas were (1) very important (2) somewhat important or (3) not very important as a resource.

IMPORTANCE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Very	1045	87.1
Somewhat	114	9.5
Not Very	21	1.7
Don't Know	17	1.4
No Response	3	0.3
Total	1200	100.0

Question 2.

The second question was designed to isolate the degree of importance each respondent placed on specific resources which forests can provide or produce. A list of seven items was read to the participant and he or she was asked to rank the personal importance of each item on a scale of 0 to 10 with 0 representing not at all important and 10 extremely important. To minimize the influence of rank/order effects, the listing of forest items was reversed on half of the questionnaires.

The overall results of this question are shown graphically in Figure 1. Nearly 63% of the respondents felt that forests were extremely important in providing food for wildlife, while watershed protection and recreational values of forests were judged to be extremely important by 54% and 48%, respectively. The second and third place rankings of watershed and recreation are not unexpected since Tucson residents have been conditioned to a high level of water conscientiousness and to the use of forests as havens from the summer heat. However, the importance given to

Table 3. Percentage of respondents in each socioeconomic category who thought that forest areas were (1) very important (2) somewhat important or (3) not very important as a resource.

	Years in Tucson			Age			Education		
Importance	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Very	87	83	89	85	89	88	**88**	89	85
Somewhat	10	12	8	11	9	8	6	10	12
Not Very	2	2	2	2	1	2	**3**	1	2
Don't Know	1	3	1	2	1	2	**3**	0	1
(Respondents)		(1197)			(1197)			(1186)	

	Annual Total Family Income					Sex	
Importance	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Very	91	89	86	85	90	86	88
Somewhat	6	8	10	13	6	10	9
Not Very	0	2	3	1	2	3	1
Don't Know	3	1	1	1	2	1	2
(Respondents)			(1041)			(1196)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

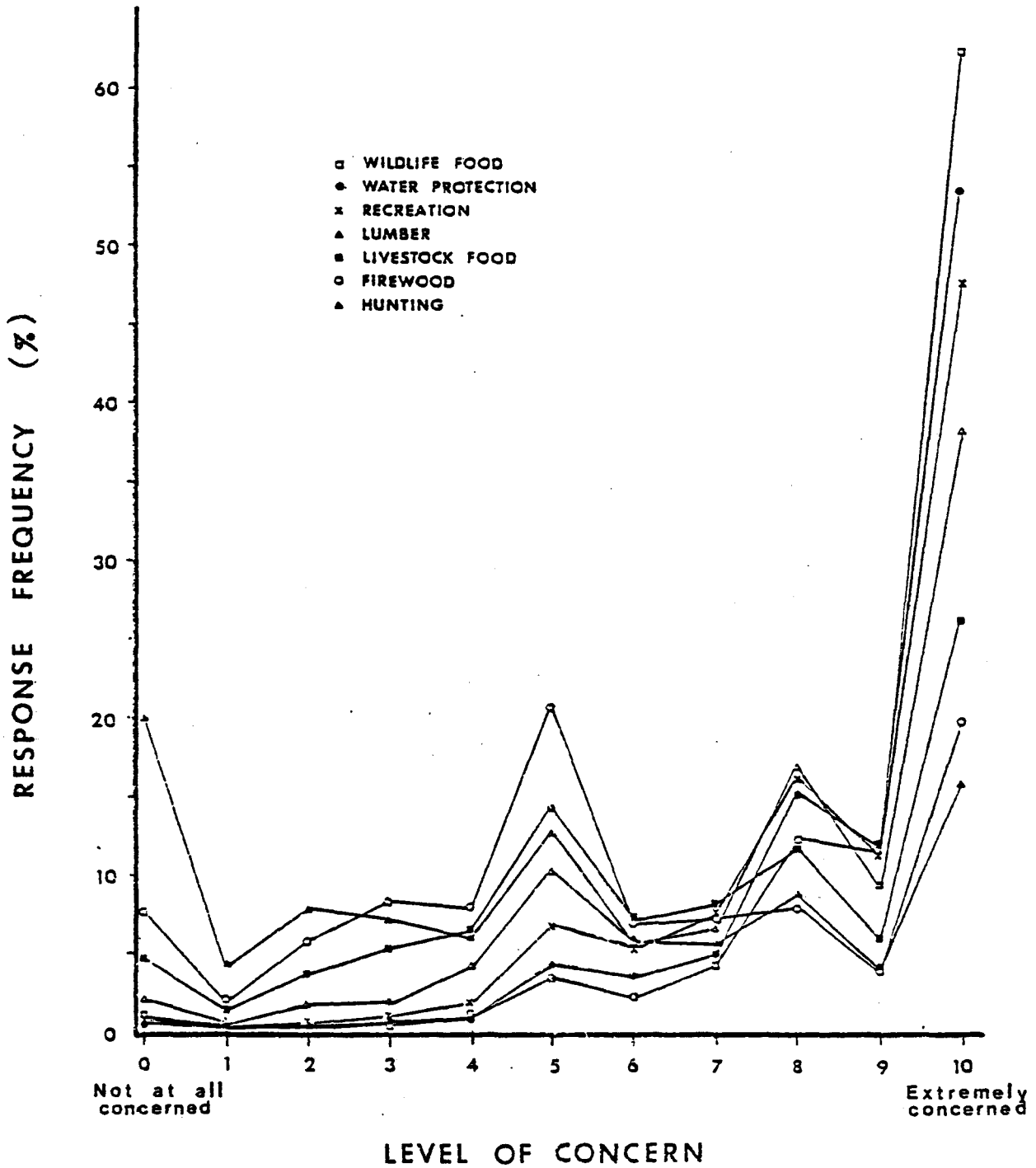

Figure 1. Percent of 1200 participants who ranked each of seven uses or products of forests for personal importance on a scale of 0 to 10.

forests as providers of wildlife food by such a large number of respondents was not anticipated. The high value placed on wildlife food is quite interesting when the survey also shows that hunting received the lowest percentage of all the seven forest values, a mere 16% of extremely important responses. The respondents appeared to be relating their own personal values towards hunting as an activity and avoiding the relationship that a forest that serves as an important wildlife food source would normally be highly valued as a source of hunting opportunities. Whatever the explanation, the general public does make a strong association between forests and wildlife, a point which should be noted by forest managers.

The importance of forests as a source of traditional tree products, namely lumber and firewood is not regarded as highly. Lumber acquired only 38% extremely important responses while firewood received less than 20%. Here again, the wording of the survey question emphasized the importance of each forest product to the respondent personally. For example, it could be pointed out that lumber should be considered an extremely important forest product since forests are the only source of lumber. However, individual respondents placed a lower degree of importance on forests for lumber, livestock grazing, firewood, and hunting in terms of their own personal needs.

Moreover, the forests near Tucson have little or no commercial timber. Forest product companies are not an important segment of the local economy and there are few Tucsonans whose jobs are dependent upon the lumber industry. Had the survey been given to residents of Tacoma, Washington, where lumber-related activities are a highly visible and important element in the local economy, for example, lumber might have had a higher degree of salience for the respondents.

When the data from this question are further cross-tabulated with socioeconomic categories, as shown in Table 4, a high degree of consistency is evident, particularly for the three highest ranked forest values.

The length of residency in Tucson showed significant differences when cross-tabulated with wildlife food, livestock food, and hunting. The longer an individual lived in Tucson, the greater importance he or she placed on these three forest values.

When the age classes of the respondents were examined for each of the forest values, significant differences were just the opposite from those obtained for the length of Tucson residency. In three forest value categories, water protection, lumber, and firewood, significance at the 5% level occurred with age, namely that older citizens placed greater importance on these values than younger individuals. It would appear that the more tangible forest products, such as fuelwood, lumber, and water, which are tied to the basic life necessities of heat, shelter, and water, become more important to an individual as she or he advances in age. The other forest value which resulted in a significant cross-tabulation with age was recreation. Here the age effect was reversed and the younger respondents placed a greater value on the use of forests as recreational areas than did older respondents. These data would tend to support the contention that younger individuals are the ones most likely to participate in hiking, camping, picnicking, and other activities in a forest environment.

The level of education showed no significant differences in responses for the three most important forest values. However, for the last four categories of forest uses, an increase in education resulted in significant decreases in the degree of importance assigned to each category. High school graduates felt that the importance of forest for lumber, livestock food, firewood, and hunting was much higher than did those with a college

Table 4. Percentage of respondents in each socioeconomic category that responded with an 8, 9, or 10 ranking (very high importance) for each of the seven uses or products of forests.

	FOOD FOR WILDLIFE	WATER PROTECTION	RECREATION	LUMBER	FOOD FOR LIVESTOCK	FIREWOOD	HUNTING
Years in Tucson							
5 or less	**84 (1)**	84 (2)	74 (1)	66 (6)	**42 (16)**	30 (25)	**24 (40)**
6 to 11	**90 (3)**	81 (<1)	78 (3)	66 (6)	**38 (17)**	34 (26)	**30 (42)**
Over 11	**89 (1)**	85 (2)	77 (3)	66 (7)	**52 (15)**	34 (22)	**31 (39)**
[Respondents]	[1186]	[1158]	[1192]	[1179]	[1145]	[1181]	[1178]
Age							
30 or less	87 (2)	**78 (3)**	**80 (1)**	55 (9)	46 (13)	**28 (23)**	27 (42)
31 to 50	88 (1)	**87 (1)**	**77 (1)**	**66 (6)**	46 (16)	**32 (27)**	30 (39)
Over 50	87 (2)	**87 (2)**	**71 (5)**	**77 (5)**	46 (18)	**39 (21)**	29 (39)
[Respondents]	[1186]	[1158]	[1192]	[1179]	[1145]	[1181]	[1178]
Education							
HS Grad	90 (1)	83 (2)	78 (3)	**70 (8)**	59 (12)	**39 (20)**	**35 (35)**
Some Col	89 (1)	84 (2)	74 (2)	**66 (6)**	**45 (14)**	**32 (26)**	**30 (38)**
Col Grad	84 (2)	84 (2)	76 (2)	**61 (6)**	**33 (21)**	**26 (26)**	**21 (47)**
[Respondents]	[1175]	[1150]	[1182]	[1170]	[1134]	[1172]	[1169]
Income							
5K or less	88 (3)	82 (0)	79 (4)	70 (4)	59 (12)	39 (23)	27 (40)
5K to 15K	88 (1)	86 (2)	76 (3)	68 (7)	49 (14)	34 (25)	26 (43)
15K to 25K	86 (1)	85 (2)	79 (2)	62 (6)	46 (13)	32 (21)	29 (38)
25K to 50K	86 (3)	85 (2)	72 (2)	67 (6)	40 (19)	30 (28)	29 (39)
Over 50K	80 (2)	80 (5)	70 (0)	72 (7)	41 (22)	38 (25)	30 (45)
[Respondents]	[1037]	[1011]	[1041]	[1027]	[1000]	[1032]	[1028]
Sex							
Male	85 (2)	82 (3)	74 (2)	66 (7)	**40 (20)**	**27 (28)**	**33 (34)**
Female	89 (1)	86 (1)	78 (3)	66 (6)	**52 (11)**	**39 (20)**	**24 (46)**
[Respondents]	[1185]	[1157]	[1191]	[1178]	[1144]	[1180]	[1177]

(Note: Numbers in parentheses indicate percentage of participants that responded with a 0, 1, 2, or 3 ranking (very low importance) for each forest use. Bold-faced numbers indicate significance at the 5% level with the Pearson Chi Square test of cross-tabulation independence.)

education. Again, the existence of a relationship between basic necessities, tangible forest products, social well-being, and educational achievement are probably being manifested.

However, it was interesting to note that none of the cross-tabulations of income levels with the importance of forest categories showed any significant differences. The lack of consistency and considerable variation among income levels within a forest category was undoubtedly a contributing factor.

There was no significant difference between male and female responses to the first four forest value categories. However, the degree of importance assigned livestock food, firewood, and hunting categories by males and females was significantly different. Females placed more importance upon forests as a source of livestock food and fuelwood than males, while males placed more importance on hunting than females.

Question 3.

Question 3 was the first of a series of questions designed to test the respondents' perception and knowledge of forest fires in general. It was felt that this baseline information was necessary to further characterize the sample population used in the study.

The third question was open-ended. The interviewer simply asked the respondents to identify, in their own words, what came to mind when they thought of a fire in a pine forest. No attempt was made to indicate whether the fire was natural or man-caused, the season of the year, or the fire size. As many responses as possible were drawn from the respondent through continued probing. The responses were recorded and analyzed in the order in which they were given.

Table 5 shows the percent distribution of 1200 initial responses by 14 categories. As respondents offered further verbal descriptions of a forest fire, these were designated as second, third, or fourth responses.

The highest percentage of initial responses, 20.1%, was an emotional word or expression describing the physical appearance or aftermath of a forest fire. Typical responses were: "destruction", "disaster", "horrible sight", "devastation", "everything charred", "desolation", and "mess".

An additional 19.0% of the respondents offered some type of fire descriptor relating to a large area, immense size, and rapid spread. Examples of words used were: "hot and fast", "roaring fire", "out of control", "wall of fire", "fast flames", "quick burning", "lots of fire", "blazing", "very big", "crackling and popping", and "intense heat".

The plight of wild animals was also identified as an initial concern held by many respondents, 16.7%, when thinking about a forest fire. These responses, in particular, were related to a fire causing animals to die, suffer, be trapped, or flee from a habitat that was being destroyed. In addition, the destruction of vegetative growth, in particular trees, was identified as the fourth ranked initial response by 15.0% of the sample population. These first four categories of initial responses account for 70.8% of the total respondents.

It is interesting to note that following the initial replies, the respondents were able to become more specific in the second, third, and fourth responses in identifying resources and values lost in a forest fire. Again, the issue of wildlife suffering and habitat destruction assumed a prominent position with the additional responses. Besides the continued concern for vegetation, particularly trees, being destroyed, environmental factors, such as recreational resources, scenic values, and air and water pollution also received considerable emphasis in the second and third

Table 5. Percent distribution of respondents' initial, 2nd, 3rd, and 4th responses by categories when asked to describe a personal vision of a forest fire.

RESPONSE CATEGORIES	INITIAL RESPONSE	SECOND RESPONSE	THIRD RESPONSE	FOURTH RESPONSE
1. Words describing appearance of an area after fire.	20.1%	6.0%	3.3%	1.8%
2. Words describing fire size, large area, or spreading.	19.0	10.1	4.3	1.6
3. Suffering, dying, fleeing animals - habitat destroyed.	16.7	23.8	13.3	4.1
4. Destruction of vegetation, particularly trees.	15.0	14.5	9.4	3.1
5. Words describing fear, terror, panic, chaos.	6.3	1.9	1.6	0.8
6. Resources damaged or destroyed, particularly recreation and scenery.	5.8	8.6	8.6	4.1
7. Air and/or water pollution.	5.4	8.2	7.0	4.2
8. Concern whether fire was natural or man-caused, arson.	4.3	2.8	1.3	1.0
9. Financial losses of property and resources.	2.8	3.7	2.7	1.5
10. Fire is probably beneficial and causing little damage.	1.7	1.3	0.6	0.4
11. Danger to or loss of human lives, including firefighting.	1.4	4.6	3.1	2.1
12. Don't know.	1.0	0	0	0
13. Other.	0.4	0.2	0.1	0.2
14. No response.	0.1	14.3	44.7	75.1
Total	100.0%	100.0%	100.0%	100.0%

responses. Even the small number of respondents who were able to offer a fourth response continued to emphasize the damage to air, water, wildlife, recreation and timber resources.

This question stated specifically, "Just imagine this kind of fire in your mind and tell me what you see." Thus, it is to be expected that initial responses focused on "what people saw": appearance - destruction, devastation, horrible sight; and fire descriptors - roaring fire, wall of fire, blazing, etc. In terms of public perception of fire, both initial and probed responses aggregated show an interesting pattern. By far the most frequently identified category, overall, was the impact of fire on wildlife and habitat. Second in importance was vegetative destruction, followed by fire size, appearance, recreation, and air and water pollution respectively. These six categories encompass 82 percent of the total responses, the wildlife concern alone accounting for one-fifth of the total responses. Past fire prevention programs and advertising depicting the destructive losses associated with wildfires and sensational footage of forest fires in movie films and newscasts probably contribute to these perceptions.

Questions 4 - 7.

After providing a verbal description of what he or she perceived a fire in a pine forest to be, the respondent was asked four questions relating to the causes, air quality effects, intensities, and acreages burned by fires in a pine forest. These questions were designed to provide some basic information on how knowledgeable respondents were concerning forest fires in general.

Question 4 asked each respondent what he or she thought starts most fires in pine forests - lightning, arson or human carelessness. Over two-

thirds of the total 1200 respondents identified human carelessness as the principal cause of those fires (Table 6). An additional 23.2% felt that lightning was the major cause. In actuality, approximately two-thirds of the forest fires in the southern Rocky Mountain region are lightning-caused. However, because of the lack of publicity, the general public is not aware of the large number of small, lightning-caused fires that occur each year on our public lands. Alternately, many of the larger man-caused and lightning fires are publicized by the news media which makes people more conscious of the destructive potential of wildfires. In other words, many citizens may be conditioned by the various media that a large number of fires are man-caused and that these fires are frequently large and destructive. It is worth noting that nearly one-fourth of the respondents did recognize lightning as a major cause of forest fires.

An examination of the cross-tabulations of Question 4 with the socio-economic categories indicates significant differences for age, education, and sex (Table 7). A higher percentage of respondents over 30 years of age identified lightning as a major cause of fires than did those under thirty

Table 6. Number and percent of respondents who thought that (1) lightning (2) arson or (3) human carelessness started most forest fires in pine forests.

CAUSE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Lightning	278	23.2
Arson	22	1.8
Carelessness	810	67.5
Don't Know	52	4.3
No Response	38	3.2
Total	1200	100.0

Table 7. Percentage of respondents in each socioeconomic category who thought that (1) lightning (2) arson or (3) human carelessness starts most forest fires in pine forests.

	Years in Tucson			Age			Education		
Cause	**<5**	**6-11**	**>11**	**<30**	**30-50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Lightning	19	27	26	**18**	**28**	**27**	**19**	**22**	**32**
Arson	2	1	2	**3**	**2**	**1**	**2**	**2**	**2**
Carelessness	74	67	68	**74**	**65**	**69**	**75**	**72**	**61**
Don't Know	5	5	4	5	5	3	4	4	5
(Respondents)		(1162)			(1162)			(1152)	

	Annual Total Family Income					Sex	
Cause	**<5K**	**5-15K**	**15-25K**	**25-50K**	**>50K**	**Male**	**Female**
Lightning	21	23	24	27	33	**27**	**20**
Arson	3	1	1	2	3	**3**	**1**
Carelessness	71	69	72	68	62	**66**	**74**
Don't Know	5	7	3	3	2	4	5
(Respondents)			(1011)			(1161)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

years of age. The same pattern, only more pronounced, was evident for the education category. Nearly one-third of the respondents who were college graduates identified lightning as a major cause, while over 70% of those with a high school education or some college training felt that human carelessness was a major fire cause. Although significant differences were not obtained for the number of years the respondents had lived in Tucson, it is possible that the results for both the older ages and higher education categories are related to the respondent's greater familiarity with southwest weather and precipitation patterns. The significantly higher percentage of males who identified lightning as a major fire cause over females may reflect a greater interest and knowledge on the part of males in events and activities that take place outdoors.

In Question 5 the respondent was asked to compare forest fire smoke as a factor in air pollution to other sources of air pollution, such as cars, factories, and unpaved roads. The results for all 1200 respondents, shown in Table 8, indicate that the general public is not overly concerned about the possible deterioration of air quality due to forest fires. Nearly 60% of the respondents thought that fire was either not a factor or a minor factor in air pollution. An additional 21.9 percent felt that forest fire smoke was a moderate air pollution factor. Again, the news reports of smog alerts in Phoenix, winter inversions temporarily trapping pollutants in the Tucson basin, and dust storms along Interstate 10 may be of more concern to many residents than an occasional large fire that may produce short-term atmospheric pollution.

Although cross-tabulations in Table 9 show significant differences for education, income and sex, interpretation of these results is difficult. Both increasing income and higher education levels reflect a greater percentage of responses in the "not a factor" or "minor factor" categories.

Table 8. Number and percent of respondents who thought that forest fire smoke was (1) not a factor (2) a minor (3) a moderate or (4) a major factor in air pollution.

LEVEL	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Not a Factor	171	14.2
Minor	534	44.5
Moderate	263	21.9
Major	98	8.2
Don't Know	126	10.5
No Response	8	0.7
Total	1200	100.0

Males also responded more frequently in these two categories than females, 68% to 50%, respectively. A factor which is probably influencing the response distribution is the large number of participants who indicated that they did not know the level of impact of forest fire smoke. In the case of both high school graduates and females this value was 15%. In addition, 15% of those with incomes less than $5,000 and 13% with incomes greater than $50,000 also gave a "do not know" response.

After tabulating the open-ended responses for Question 3, in which the participants were asked to describe a personal vision of a forest fire, the results obtained for Question 6 were not unexpected. Question 6 asked each respondent how intense he or she thought most forest fires are. Both the degree of hotness and the height of flames were identified as intensity parameters. Over 75% of the total 1200 respondents thought that most forest fires are very hot with high flames (Table 10). Another 13% felt that these fires are moderately hot with medium - size flames, while only

Table 9. Percentage of respondents in each socioeconomic category who thought that forest fire smoke was (1) not a factor (2) a minor (3) a moderate or (4) a major factor in air pollution.

	Years in Tucson			Age			Education		
Level	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
Not a Factor	11	18	15	13	16	15	13	14	16
Minor	44	42	46	46	45	43	36	50	50
Moderate	24	24	20	23	22	22	25	21	20
Major	8	8	9	6	7	11	11	7	6
Don't Know	13	8	10	12	10	9	15	8	8
(Respondents)		(1192)			(1192)			(1183)	

	Annual Total Family Income					Sex	
Level	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
Not a Factor	5	12	11	19	23	18	11
Minor	39	46	47	47	48	50	39
Moderate	25	23	24	23	6	18	26
Major	16	9	8	5	10	8	9
Don't Know	15	10	10	6	13	6	15
(Respondents)			(1038)			(1191)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

17 respondents (1.4%) identified most fires as being not very hot with low flames. From Question 3 it is known that a large number of participants initially described a fire in a pine forest as being large, destructive, and rapid-moving. The same perception of a forest fire is reinforced by the responses to Question 6.

The discussion presented for Question 4 may also be pertinent here. The lack of awareness by the general public of forest fire causes and the misconception which many people have about the destructiveness of most forest fires because of media publicity may aid in explaining the distribution of responses. The only significant cross-tabulation for Question 6 is in the number of years the respondents have resided in Tucson (Table 11). The 6- to 11- year residents viewed fire somewhat more moderately than did those with fewer than five years or with greater than 11 years in Tucson. Other socioeconomic categories did not show any significant cross-tabulation differences.

Table 10. Number and percent of respondents who thought that most forest fires are (1) not very hot with low flames (2) moderately hot with medium-size flames or (3) very hot with high flames.

INTENSITY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Not Very Hot	17	1.4
Moderately Hot	156	13.0
Very Hot	921	76.8
Don't Know	102	8.5
No Response	4	0.3
Total	1200	100.0

Table 11. Percentage of respondents in each socioeconomic category who thought that most forest fires are (1) not very hot with low flames (2) moderately hot with medium-size flames or (3) very hot with high flames.

	Years in Tucson			Age			Education		
Intensity	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Not Very Hot	1	1	1	2	1	1	1	2	1
Moderately Hot	13	20	11	14	13	12	11	12	17
Very Hot	77	71	80	77	76	78	79	78	74
Don't Know	9	8	8	7	10	9	9	8	8
(Respondents)		(1196)			(1196)			(1187)	

	Annual Total Family Income					Sex	
Intensity	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Not Very Hot	2	2	2	1	0	1	1
Moderately Hot	9	12	13	14	6	15	11
Very Hot	81	78	76	77	89	77	78
Don't Know	8	8	9	8	5	7	10
(Respondents)			(1042)			(1195)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Question 7 is closely related to Questions 3, 4, and 6 and further emphasizes the public's perception of most forest fires as being large and uncontrolled. Question 7 asked how much area the respondent thought most forest fires burn. The possible choices included less than 1 acre, 1 to 100 acres, hundreds of acres, thousands of acres, or don't know. As indicated in Table 12, over 10% of the responses were in the "don't know" category. Of those participants that did respond, 43.6% thought that most forest fires burn thousands of acres, 30.3% thought hundreds of acres, and 14.8% placed most fires in the 1- to 100- acre category. Only 12 of the 1200 respondents (1.0%) thought that most fires burn less than 1 acre. Fire statistics, normally not available to the general public, indicate that a majority of the fires are Class A or less than one-quarter acre. The lack of knowledge of fire statistics and publicity of large fires has allowed the public to maintain a false picture of average fire size in a pine forest.

Table 12. Number and percent of respondents who thought that most forest fires burn (1) less than 1 acre (2) between 1 and 100 acres (3) hundreds of acres or (4) thousands of acres.

ACREAGE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Less than 1	12	1.0
1 to 100	178	14.8
100's	364	30.3
1000's	523	43.6
Don't Know	121	10.1
No Response	2	0.2
Total	1200	100.0

Educational levels and sex were the two socioeconomic variables which exhibited significant differences when cross-tabulated with perceived fire acreage (Table 13). Higher education levels and males both show a response shift towards smaller fire acreage. In the case of education this may simply mean a greater knowledge of fire in forests gained through courses, readings, or personal interest, while the high percentage of females with "don't know" responses probably contributed to the detection of significance in the sex category.

The responses to Questions 4 through 7 indicate that the general public is not very familiar with the principal causes, normal intensities, and average acreages burned by most fires in pine forests. Survey respondents are also not overly concerned about the possible detrimental impacts of forest fire smoke on atmospheric conditions.

The opportunities for information and education programs to remove some of these public misconceptions surrounding forest fires is quite apparent. A publicity campaign involving both electronic and printed media may be very effective in increasing the awareness level of the general public on many fire management issues.

Questions 8 & 9.

The next two questions presented to each respondent were specifically related to a fire that is burning only underbrush and debris in a pine forest. At this point in the survey many of the participants were being asked to put aside their previous perceptions of fire in pine forests and to relate their personal feelings to a much less intense, less spectacular type of forest fire.

Question 8 inquired whether the respondent thought that a fire burning only underbrush and debris in a pine forest should be allowed to burn or

Table 13. Percentage of respondents in each socioeconomic category who thought that most forest fires burn (1) less than 1 acre (2) between 1 and 100 acres (3) hundreds of acres or (4) thousands of acres.

	Years in Tucson			Age			Education		
Acreage	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Less than 1	1	2	1	1	1	1	0	1	1
1 to 100	15	19	13	15	17	13	11	16	18
100's	28	30	33	29	33	29	28	33	31
1000's	45	39	44	43	42	46	49	42	39
Don't Know	11	10	9	12	7	11	12	8	11
(Respondents)		(1198)			(1198)			(1188)	

	Annual Total Family Income					Sex	
Acreage	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Less than 1	1	1	1	2	0	1	1
1 to 100	6	16	12	19	21	19	10
100's	30	28	32	31	24	30	31
1000's	50	44	46	40	50	44	44
Don't Know	13	11	9	8	5	6	14
(Respondents)			(1043)			(1197)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

whether the fire should be put out. The results from this question are of interest in light of the responses to previous questions relating to fire intensities, rates of spread, and sizes. Thirty-eight percent of the respondents felt that an underbrush/debris fire in pine forests should be allowed to burn (Table 14). Nearly half of the 1200 responses favored putting the fire out and 13% offered a "don't know" answer. When it is kept in mind that approximately 3 out of every 4 respondents in the survey believed that fires in pine forests are very hot with high flames and that they burn 100's or 1,000's of acres, a much lower percentage of "allowed to burn" responses for Question 8 could have been anticipated. Although a number of "don't know" answers were given, there appears to be a definite realization on the part of the respondents that the presence of some types of fires in pine forest may be acceptable. On the other hand, the wording of the question specifically for underbrush and debris fires may have caused a realization by some respondents that possibly not all fires are large conflagrations.

Table 14. Number and percent of respondents who thought that a fire burning only underbrush and debris in a pine forest should (1) be allowed to burn or (2) be put out.

OPTION	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Allowed to Burn	456	38.0
Put Out	583	48.6
Don't Know	156	13.0
No Response	5	0.4
Total	1200	100.0

Table 15. Percentage of respondents in each socioeconomic category who thought that a fire burning only underbrush and debris in a pine forest should (1) be allowed to burn or (2) be put out.

	Years in Tucson			Age			Education		
Option	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Allowed to Burn	34	35	42	31	44	39	29	41	46
Put Out	53	47	47	58	40	48	56	48	41
Don't Know	13	18	11	11	16	13	15	11	13
(Respondents)		(1195)			(1195)			(1186)	

	Annual Total Family Income					Sex	
Option	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Allowed to Burn	28	35	38	46	37	45	31
Put Out	65	49	50	39	53	44	54
Don't Know	7	16	12	15	10	11	15
(Respondents)			(1040)			(1194)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Cross-tabulations of socioeconomic factors for this question indicate significant differences within all five categories (Table 15). Respondents who have lived in Tucson for over eleven years, are between 30 and 50 years of age, have a college degree, earn from $25,000 to $50,000 annual family income, and are males show a significantly higher percentage of responses in the "allowed to burn" category. This may be due to an increased consciousness on the part of these individuals to the increased prescribed burning and natural fire programs being implemented by the U.S. Forest Service and the National Park Service in the Tucson area during recent years.

Question 9 is somewhat unique in that it asked a very specific question concerning the possible role of fire as a factor in changing the vegetation of a pine forest. The respondent was requested to think how a fire burning only underbrush and debris would affect a pine forest; specifically, would it make room and allow other trees to replace the pines or would the fire help to keep the area a pine forest? As was expected with such a technical question, a large percentage (38.3%) of the total responses was in the "don't know" category (Table 16). A substantial majority of the remaining respondents indicated that they thought the fire would help to keep the area a pine forest. It is difficult to assess whether the individuals who thought the area would remain a pine forest were really knowledgeable about fire ecology or whether they intuitively sensed that an understory/debris fire would not be destroying the overstory pine and, therefore, the pine forest would remain after fire.

The cross-tabulation results in Table 17 indicate significant differences for both educational levels and sex. The participants with college degrees responded with fewer "don't know" and more "keep pines" answers than did those with only a high school or some college education.

Table 16. Number and percent of respondents who thought that a fire burning only underbrush and debris in a pine forest would (1) make room and allow other trees to replace pines or (2) keep the area a pine forest.

EFFECT	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Replace Pines	318	26.5
Keep Pines	415	34.6
Don't Know	460	38.3
No Response	7	0.6
Total	1200	100.0

A similar pattern of responses also emerged for males when compared to females. Length of Tucson residency, age, and total annual family income did not show any significant differences.

Questions 10 - 13.

The next four survey questions were directed to the possible effects of fire on a forest ecosystem. In contrast to the previous two questions which were related to a fire of lower intensity and slower rates of spread, the respondent was now asked to think in terms of a rapidly moving, intense forest fire. These questions were included to provide further information on the public perception of fire effects and potential resource damage. Earlier questions, Question 1 and 2, had established that the public, in general, placed a high value on forests. The role of fire as an element or factor in these forests as perceived by the survey participants was now being evaluated.

Question 10 dealt directly with the effects of an intense, rapidly spreading forest fire on wild animals. The respondent was asked how many animals he or she thought would be killed in such a fire - none, a few, a

Table 17. Percentage of respondents in each socioeconomic category who thought that a fire burning only underbrush and debris in a pine forest would (1) make room and allow other trees to replace pines or (2) keep the area a pine forest.

	Years in Tucson			Age			Education		
Effect	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Replace Pines	26	29	26	25	27	28	**25**	29	**26**
Keep Pines	32	37	36	36	35	33	**29**	37	**39**
Don't Know	42	34	38	39	38	39	**46**	**34**	**35**
(Respondents)		(1193)			(1193)			(1185)	

	Annual Total Family Income					Sex	
Effect	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Replace Pines	19	26	27	31	31	**29**	**24**
Keep Pines	30	36	36	34	34	**39**	**31**
Don't Know	51	38	37	35	35	**32**	**45**
(Respondents)			(1038)			(1192)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

moderate number, or a lot of animals. Once again the responses indicated a very strong public interest in wildlife (Table 18). An overwhelmingly large percentage of the respondents expressed the feeling that a rapidly moving, intense forest fire would kill lots of animals (58.7%). An additional 28.9% indicated that a moderate number would be lost. No attempt was made in the question to identify the meaning of the word "animals". However, it is probably safe to assume that most respondents had many of the larger mammals and birds which reside in forests in mind when answering. Most forest managers and fire professionals, in particular, recognize that actual animal mortality following an intense wildfire is often quite low. Animals and birds capable of flight are frequently able to successfully flee a forest fire. Occasionally, an especially rapid fire run may trap animals and cause their death through suffocation or heat. Many of the smaller rodents are also able to escape in underground tunnels and rock outcrops.

Table 18. Number and percent of respondents who thought that a rapidly moving, intense forest fire would kill (1) no animals (2) few (3) a moderate number or (4) lots of animals.

MORTALITY	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
No animals	1	0.1
Few	92	7.7
Moderate	347	28.9
Lots	705	58.7
Don't know	53	4.4
No Response	2	0.2
Total	1200	100.0

Another factor which may explain the high number of animals that many participants thought would be killed in a forest fire is the relationship between wildlife habitat and survival. It was evident from Question 2 that the public considers forests to be a very valuable source of wildlife food. Quite possibly many of the respondents were relating animal deaths to both the effects of direct fire kill and the possible aftermath deaths caused by the destruction of food sources and habitat.

The socioeconomic cross-tabulations for Question 10 are shown in Table 19. Although a significant difference was obtained for annual total family income, an interpretation of the results is difficult. The 10% "don't know" responses for those with incomes greater than $50,000 is unusual when compared with the other categories and may have caused the significant difference. The percent of females who thought that lots of animals would be killed is significantly higher than that for males. However, because of their greater interest in hunting men may be more familiar with wildlife movements and fire effects which may have resulted in a more conservative estimate of animal mortality. On the other hand women may be more concerned with protecting aesthetic, non-commodity, and nonconsumptive forest uses.

Question 11 asked each participant how much of a factor he or she thought a rapidly moving, intense forest fire was in the pollution of water when compared to other water pollution sources, such as sewage plants, industrial wastes, and urban runoff. Table 20 shows that nearly 45% of the total 1200 respondents felt that forest fires were either not a factor or a minor factor in the pollution of water. An additional 27% thought that fire was a moderate factor, while 12.9% identified it as a major factor. Fifteen percent of the survey participants did not know how to respond or offered no response.

Table 19. Percentage of respondents in each socioeconomic category who thought that a rapidly moving, intense forest fire would kill (1) no animals (2) few (3) a moderate number or (4) lots of animals.

	Years in Tucson			Age			Education		
Mortality	**<5**	**6-11**	**>11**	**<30**	**30-50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
No animals	0	0	0	0	0	0	0	0	0
Few	5	10	9	7	7	9	7	6	10
Moderate	29	32	28	30	29	28	30	29	29
Lots	61	54	59	61	60	56	60	60	56
Don't Know	5	4	4	2	4	7	3	5	5
(Respondents)		(1198)			(1198)			(1187)	

	Annual Total Family Income					Sex	
Mortality	**<5K**	**5-15K**	**15-25K**	**25-50K**	**>50K**	**Male**	**Female**
No animals	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Few	**9**	**9**	**6**	**8**	**6**	**10**	**5**
Moderate	**23**	**29**	**28**	**33**	**21**	**33**	**25**
Lots	**67**	**58**	**62**	**54**	**63**	**53**	**65**
Don't Know	**0**	**4**	**4**	**5**	**10**	**4**	**5**
(Respondents)			(1042)			(1197)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

It is interesting to note the similarities in responses to this question and to those for Question 5, which dealt with the potential impact of forest fires as a source of air pollution. Although, in Question 5, the respondent was not specifically asked to think in terms of a rapidly moving, intense forest fire as he or she was for Question 11. However, the picture of fire held by many individuals as evidenced by Question 3 was one of rapid spread and high intensity. Nearly 59% of the respondents to Question 5 (Table 8) thought that forest fire smoke was either not a factor or a minor factor in air pollution, while 44.8% felt that fire was either not a factor or a minor factor in water pollution (Table 20). Fire as a moderate factor in pollution received 21.9% and 27.3% responses for air and water pollution, respectively. More participants (12.9%) felt that fire was a major factor in water pollution than in air pollution (8.2%). The percentage of "don't know" responses was also greater for water pollution.

Table 20. Number and percent of respondents who thought that a rapidly moving, intense forest fire would (1) not be a factor in water pollution (2) be a minor (3) a moderate or (4) a major factor in water pollution.

LEVEL	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Not a Factor	141	11.8
Minor	396	33.0
Moderate	328	27.3
Major	155	12.9
Don't Know	173	14.4
No Response	7	0.6
Total	1200	100.0

These data indicate that, in general, the public does not appear to regard forest fires, even those with rapid rates of spread and high intensities, as a cause for intolerable levels of air or water pollution. However, it is evident that water pollution as a result of fire is considered to be more serious than air pollution. Table 4 has already shown that over 80% of the survey respondents gave an 8, 9, or 10 ranking (very high importance) to the value of forests for water protection. Again, the temporary, transitory nature of forest fire smoke in polluting the atmosphere may be viewed by the public as being less important than the longer term, continually visible flow of muddy water from a burned watershed.

When the cross-tabulations of Question 5 (Table 9) and Question 11 (Table 21) with socioeconomic categories are examined, the similarities between the two questions continue. In both tables, education, annual total family income, and sex show significant differences. The response pattern for each category, including the years in Tucson and age, is also closely related. As mentioned previously for Question 5, interpretating the significance in differences for education, income, and sex is difficult. Those individuals who are better educated, have higher incomes, and are males apparently consider fire a less important factor in both air and water pollution. However, the increased seriousness of water pollution when compared with air pollution is evident in all socioeconomic categories.

Question 12 dealt directly with the issue of soil erosion following fire. The respondent was asked how much soil erosion he or she thought resulted from a rapidly moving, intense forest fire. The responses were either no erosion, minor, moderate, severe soil erosion, or don't know. The overall results for 1200 survey participants (Table 22) indicate the presence of a very strong feeling that a forest fire of rapid spread and

Table 21. Percentage of respondents in each socioeconomic category who thought that a rapidly moving, intense forest fire would (1) not be a factor in water pollution (2) be a minor (3) a moderate or (4) a major factor in water pollution.

	Years in Tucson			Age			Education		
Level	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
Not a Factor	11	16	11	12	12	12	9	13	14
Minor	35	30	33	36	31	32	29	32	40
Moderate	27	29	27	28	29	26	29	29	24
Major	11	12	15	13	12	13	16	14	8
Don't Know	16	13	14	11	16	17	17	12	14
(Respondents)		(1193)			(1193)			(1183)	

	Annual Total Family Income					Sex	
Level	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
Not a Factor	8	11	10	15	18	14	10
Minor	24	36	29	37	24	39	27
Moderate	36	23	31	29	31	26	29
Major	9	13	16	9	13	13	13
Don't Know	23	17	14	10	14	8	21
(Respondents)			(1037)			(1192)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

high intensity will result in serious soil erosion. Over three-fourths of the respondents felt that such a fire would cause moderate or severe soil erosion. In light of the responses to Question 11 on water pollution effects, there appears to be some degree of distinction being made by the general public between water pollution and soil erosion. It is possible that the public view of soil erosion is more encompassing than that for water pollution. The public may recognize that sediments eroded from a burned watershed can end up in a stream or river and ultimately cause water pollution, but to many the term "soil erosion" may also mean destructive mudslides, mass movement, and land slumpage or even wind-blown soil which may never reach a watercourse. In other words, many individuals may be relating soil erosion to the mudslides following fires in southern California or to sediment transported across highways following brief storms on burned areas. Others, based on personal knowledge or intuition, may recognize that an intense fire can remove the vegetation and litter which protects the soil against erosion.

Table 22. Number and percent of respondents who thought that a rapidly moving, intense forest fire would result in (1) no soil erosion (2) minor (3) moderate or (4) severe soil erosion.

LEVEL	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
No Erosion	23	1.9
Minor	102	8.5
Moderate	300	25.0
Severe	633	52.8
Don't Know	139	11.6
No Response	3	0.2
Total	1200	100.0

Socioeconomic cross-tabulations for Question 12 (Table 23) indicate significant differences for the education and sex categories. The difference for education is related to the shift from "don't know" responses for college graduates to the "severe erosion" level. This would suggest that the participants with higher education are more secure in providing a response to the question and that a number, possibly because of personal knowledge or previous coursework, selected "severe erosion." Although a significant difference has been calculated for the sex category, it can be attributed to the shift from "don't know" responses by males to the remaining four erosion levels.

Question 13, the last one concerned with the effects of a rapidly moving, intense forest fire, examined the reestablishment of vegetation following fire. Specifically, the respondent was asked how long it would take before grasses and other vegetation began to grow back after a rapid, intense forest fire. The time period categories were within 1 year, 1 to 3 years, 3 to 5 years, or never.

Nearly a third of the survey participants responded that grasses and other vegetation would return to the burned site within 1 year (Table 24). Slightly lower response percentages, 29.9% and 28.9%, were obtained for the 1 to 3 years and 3 to 5 years categories, respectively. Less than 3% of the total 1200 participants felt that grasses and other vegetation would never grow back. Apparently, there is very little doubt on the part of the general public that burned over areas will ultimately be revegetated.

In actuality, much of the revegetation on a burned area becomes established in the first year following fire. This may take place through natural site seeding and sprouting or, in many cases, by agency or industry reseeding programs. The cross-tabulation data in Table 25 show that education, income, and sex exhibit a significant chi square value at the 5%

Table 23. Percentage of respondents in each socioeconomic category who thought that a rapidly moving, intense forest fire would result in (1) no soil erosion, (2) minor (3) moderate or (4) severe soil erosion.

	Years in Tucson			Age			Education		
Level	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
No Erosion	2	2	2	2	1	2	2	2	2
Minor	9	8	8	11	8	7	9	9	8
Moderate	26	27	23	24	28	23	23	27	25
Severe	49	50	57	51	55	53	49	52	58
Don't Know	14	13	10	12	8	15	17	10	7
(Respondents)	(1197)			(1197)			(1186)		

	Annual Total Family Income					Sex	
Level	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
No Erosion	0	2	2	2	5	3	1
Minor	7	10	8	10	8	10	7
Moderate	23	21	27	25	21	26	24
Severe	48	53	52	55	60	54	52
Don't Know	22	14	11	8	6	7	16
(Respondents)	(1041)					(1196)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 24. Number and percent of respondents who thought that after a rapidly moving, intense forest fire grasses and other vegetation would begin to grow back within (1) 1 year (2) 1 to 3 years (3) 3 to 5 years or (4) never.

TIME	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Within 1 Year	374	31.2
1 to 3 Years	359	29.9
3 to 5 Years	347	28.9
Never	28	2.3
Don't Know	86	7.2
No Response	6	0.5
Total	1200	100.0

level for this question. A much higher percentage of college graduates responded in the "within 1 year" category than did those participants with some high school education or a high school diploma. With no clear pattern of responses for the annual total family income category it is difficult to interpret any meaningful relationships. A significantly higher percentage of males than females felt that a burned site would be revegetated within one year following fire. It is possible that hunting and other field activities by males, where revegetation and site changes following fire can be observed, have given males a better perspective of what actually happens.

Question 14.

The level of personal concern which each respondent had for the possible impacts of a forest fire on seven resource values was determined from Question 14. A list of seven possible fire impacts was read to the

Table 25. Percentage of respondents in each socioeconomic category who thought that after a rapidly moving, intense forest fire grasses and other vegetation would begin to grow back within (1) 1 year (2) 1 to 3 years (3) 3 to 5 years or (4) never.

	Years in Tucson			Age			Education		
Time	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Within 1 Year	31	36	30	30	34	31	24	31	40
1 to 3 Years	30	28	31	29	28	33	31	30	29
3 to 5 Years	29	29	29	34	28	25	32	30	24
Never	2	2	3	2	2	2	5	2	1
Don't Know	8	5	7	5	8	9	8	7	6
(Respondents)	(1194)			(1194)			(1185)		

	Annual Total Family Income					Sex	
Time	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Within 1 Year	20	29	30	37	34	38	25
1 to 3 Years	35	31	29	31	32	33	27
3 to 5 Years	31	29	33	27	26	24	34
Never	8	2	1	2	2	2	3
Don't Know	6	9	7	3	6	3	11
(Respondents)	(1039)					(1193)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

participant and he or she was asked to rank his or her personal concern of each item on a scale of 0 to 10 with 0 representing not at all concerned and 10 extremely concerned. Rank/order effects were minimized by reversing the listing of items on half of the questionnaires.

Figure 2 is a graphical representation of the overall results for this question from 1200 respondents. Examination of the categories which received responses of "10", or an expression of extreme concern, reveal three rather distinct groupings. The destruction of trees, the loss of wild animals, and the loss of food for wild animals received 58.8%, 57.1%, and 56.5% of the total responses in the "10" category, respectively. It is interesting to note that in Question 2 (Figure 1) lumber ranked 4th and firewood 6th in a listing of seven forest values considered to be extremely important to the respondents. It appears that the public considers other forest values, namely wildlife food, watershed protection and recreation, to be more important than lumber or wood products. However, when fire is introduced as a potential impact, the public is very much concerned about the possible destruction of trees. In the latter situation there may be a broader value being placed on trees other than as a source of lumber or firewood. The survey participants could be relating the destruction of trees not only to the loss of lumber but also to the loss of a vegetation type which protects watersheds, serves as wildlife habitat, offers recreational opportunities and the like. This wider view of the role of trees in a forest ecosystem may account for the extreme concern which the public has for the potential loss of these trees due to fire.

The extreme concern expressed by a large number of respondents on the possible loss of wildlife and wildlife food is further reinforcement of the public attitude toward wildlife which has already been detected in Questions 2, 3, and 10. The general public holds a very close and personal

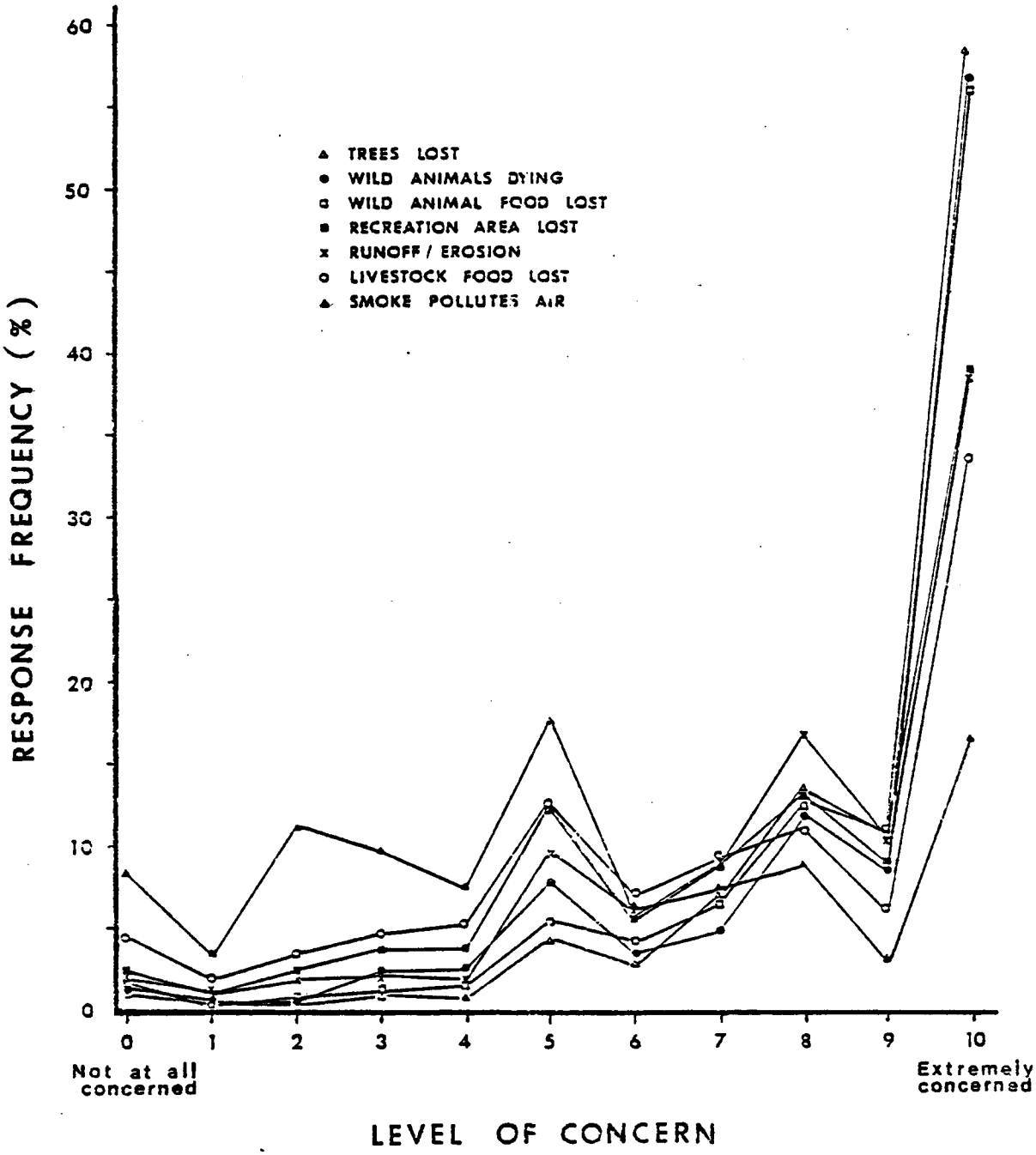

Figure 2. Percent of 1200 participants who ranked each of seven possible impacts of a forest fire for personal concern on a scale of 0 to 10.

attachment to wildlife and is quite concerned about any action or activity which may adversely impact upon these natural inhabitants of a forest ecosystem.

The second group of responses receiving a rating of extreme concern or "10" includes the impacts of a forest fire on the destruction of recreation areas (39.4%), increased water runoff, erosion, and mudslides (38.8%), and the loss of livestock food sources (33.7%). All three of these categories occupied similar positions in Question 2 where their importance as a value in a forest was identified. These values and the public's concern for their potential loss due to forest fire appear to be quite parallel.

Concern that a forest fire would cause smoke which pollutes the air ranked considerably lower than the other six possible impacts. Only 16.6% of the 1200 respondents expressed a rating of "10" or extreme concern for this impact. This result correlates closely to the responses received for Question 5 where over half of the survey participants thought that forest fire smoke was not a factor or only a minor factor in air pollution.

The cross-tabulation of socioeconomic categories with the responses to each possible impact of a forest fire are presented in Table 26. Although significant differences at the 5% level were obtained in three of the seven impact categories for Tucson residency time, a reasonable interpretation of these responses is difficult. It should be noted that the values which appear in the table are a summation of the percent responses for only the highest three levels of concern, namely 8, 9, and 10 ratings. In actuality, the test of significance is based on the responses for all eleven levels of concern, from 0 through 10, and not on just 8, 9, and 10 values. Albeit, with the exception of the runoff/soil erosion category, there appears to be a pattern in the responses for the other six impacts which relate to the years in Tucson. Those participants who have

Table 26. Percentage of respondents in each socioeconomic category that responded with an 8, 9, or 10 ranking (very high concern) for each of seven possible impacts of a forest fire.

	TREES LOST	WILD ANIMAL FOOD LOST	WILD ANIMALS DYING	RUNOFF/ SOIL EROSION	RECRE-ATION AREAS LOST	LIVE-STOCK FOOD LOST	SMOKE POLLUTES AIR
Years in Tucson							
5 or less	85 (1)	81 (3)	**78 (2)**	**66 (5)**	64 (7)	51 (14)	**30 (27)**
6 to 11	78 (4)	75 (3)	**74 (4)**	**67 (8)**	55 (11)	45 (16)	**25 (38)**
Over 11	84 (2)	81 (3)	**79 (5)**	**69 (7)**	62 (9)	54 (14)	**29 (34)**
[Respondents]	[1192]	[1194]	[1191]	[1169]	[1190]	[1177]	[1186]
Age							
30 or less	**80 (2)**	83 (2)	80 (3)	**60 (6)**	62 (9)	52 (11)	30 (29)
31 to 50	**82 (2)**	77 (4)	76 (5)	**69 (6)**	62 (8)	49 (15)	25 (36)
Over 50	**87 (3)**	80 (3)	77 (5)	**73 (6)**	60 (9)	53 (17)	31 (33)
[Respondents]	[1192]	[1194]	[1191]	[1169]	[1190]	[1177]	[1186]
Education							
HS Grad	86 (2)	**87 (2)**	**84 (2)**	71 (6)	**70 (6)**	**67 (10)**	**38 (25)**
Some Col	84 (2)	**81 (2)**	**77 (5)**	64 (7)	**56 (11)**	**48 (13)**	**25 (36)**
Col Grad	80 (3)	**72 (6)**	**71 (8)**	67 (6)	**57 (9)**	**37 (20)**	**20 (39)**
[Respondents]	[1182]	[1183]	[1182]	[1158]	[1179]	[1167]	[1175]
Income							
5K or less	86 (1)	82 (3)	82 (8)	76 (7)	**75 (7)**	66 (9)	**47 (18)**
5K to 15K	84 (3)	82 (4)	78 (4)	71 (6)	**65 (13)**	54 (14)	**32 (32)**
15K to 25K	82 (1)	83 (2)	81 (2)	66 (4)	**62 (6)**	51 (10)	**29 (30)**
25K to 50K	82 (3)	74 (5)	73 (5)	65 (7)	**55 (10)**	44 (20)	**20 (40)**
Over 50K	87 (5)	67 (5)	66 (7)	61 (13)	**52 (8)**	40 (18)	**18 (43)**
[Respondents]	[1040]	[1040]	[1038]	[1022]	[1038]	[1028]	[1036]
Sex							
Male	**79 (3)**	**72 (4)**	**70 (6)**	64 (6)	**56 (12)**	**42 (19)**	**21 (42)**
Female	**88 (2)**	**88 (2)**	**86 (2)**	71 (6)	**66 (6)**	**61 (10)**	**36 (23)**
[Respondents]	[1191]	[1193]	[1190]	[1168]	[1189]	[1176]	[1185]

(Note: Numbers in parentheses indicate percentage of participants who responded with a 0, 1, 2, or 3 ranking (very low importance) for each fire impact. Boldface numbers indicate significance at the 5% level with the Pearson Chi Square test of cross-tabulation independence.)

lived less than 5 and more than 11 years in Tucson seem to express a greater degree of concern about the possible impacts of a forest fire than did those residents who have lived in Tucson between 6 and 11 years. This could be an age-dependent relationship where younger, more environmentally conscious and older, more conservative participants are responding more frequently in the higher concern categories, i.e., 8, 9, and 10.

A similar, but not as well-defined pattern, can be detected in the cross-tabulations of age with the impact categories. Two impacts, the destruction of trees and runoff/soil erosion, show significance with the respondents' age. In both cases an increase in age reflects an increase in the percentage of high concern responses. These data tend to support those presented for Question 2 where a significant difference was obtained when age was cross-tabulated with the importance of forests for water protection, lumber, and firewood. For each of these three forest uses, an increase in age resulted in an increase in the percentage of very high importance responses. Apparently, older respondents not only place a higher level of importance on forests for water protection, lumber, and firewood, but they also are more concerned about the possible loss of trees and increases in runoff and soil erosion following a forest fire. As previously mentioned, older respondents may be placing a greater value upon forests as providers of some of life's basic necessities than do younger participants.

When the educational levels of the respondents were examined for each of the forest fire impacts, significant differences were found in five of the seven categories. In all five there were decreases in the percentage of high concern responses with increases in educational levels. College graduates were much less concerned about the possible impacts of a forest fire on the loss of wildlife or wildlife food, destruction of recreation

areas, loss of livestock food, and smoke pollution. These results may reflect a somewhat broader knowledge of possible forest fire impacts by those participants with higher levels of education.

Only two forest fire impact categories, destruction of recreation areas and smoke pollution, showed significant differences when cross-tabulated with income levels. In both cases an increase in the income level resulted in a decrease in the percentage of high concern responses. It is possible that those with higher incomes and greater economic stability feel less dependent upon the resources of the forest and less concerned about possible impacts of forest fires.

In six of the seven possible impact categories females showed a significantly greater percentage of high concern responses than males. This pattern of responses where females are more conservative and less likely to tolerate changes or impacts to a forest ecosystem has already been evidenced in earlier questions.

Question 15.

Question 15 was especially interesting because it asked each survey participant to personally rank their own level of knowledge regarding the effects of forest fires. This question offered insights on whether a respondent was comfortable in answering questions on forest fires and whether the general public did, in fact, consider itself reasonably knowledgeable about the effects of forest fires. A scale of 0 to 10 was used, where 0 was an indication of no knowledge and a response of "10" revealed that the respondent felt that he or she was very knowledgeable about forest fire effects.

The overall results for 1200 participants are shown in Table 27. The largest percentage of responses, nearly 25%, was for a value of "5",

Table 27. Number and percent of respondents who ranked their personal knowledge about the effects of forest fires on a scale of 0 to 10 where 0 is no knowledge and 10 is very knowledgeable.

SCALE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
0	41	3.4
1	11	0.9
2	60	5.0
3	114	9.5
4	137	11.4
5	295	24.6
6	158	13.2
7	168	14.0
8	130	10.8
9	18	1.5
10	55	4.6
No Response	13	1.1
Total	1200	100.0

representing the average knowledge level. This value may be somewhat biased because of the tendency for respondents to select the mid-point value when a numerical rating scale is used in survey research. There is, however, a substantial difference between the 44% responses obtained for the 5 highest values (6 through 10) and the 30% responses received for the 5 lowest values (0 through 4). This is an indication that the general public views itself as possessing a better than average knowledge about the effects of forest fires. What bearing this self-perceived level of forest fire knowledge by the public will have on future education and publicity campaigns of management agencies remains to be seen. These results would

imply that more detailed and sophisticated public awareness and information programs regarding the role of fire in the forest ecosystem may be very effective. In other words, not to furnish information to the public because of a feeling that it would not be understood may neither be an accurate evaluation of public knowledge nor an effective public relations approach.

The cross-tabulations of socioeconomic categories with rating scale values are presented in Table 28. The scale responses have been distributed into five groups representing low, below average, average, above average, and high knowledge levels.

Significant cross-tabulation differences were detected for four of the five socioeconomic categories. In the age category, those respondents over 50 years old showed the greatest variability in responses. These older participants responded more frequently in both the low knowledge and the high knowledge level of the rating scale than did the two younger age groups. The greater responses in the high knowledge group may reflect more accumulated knowledge over the years for the older respondents.

As would be expected, survey participants with some college background or a college degree offered a higher percentage of responses in the more knowledgeable categories than did the respondents with only a high school education.

The significant differences obtained for the cross-tabulations with annual total family income are difficult to explain. A major change occurs in the highest income category where the percentage of responses in the higher knowledge portion of the rating scale is substantial greater.

In examining the results between males and females for this question, it is readily apparent that males felt that their knowledge level about forest fire effects was quite high (52% for the 5 highest values). This

Table 28. Percentage of respondents in each socioeconomic category who ranked their personal knowledge about the effects of forest fires on a scale of 0 to 10 where 0 is no knowledge and 10 is very knowledgeable. For easier evaluation the scale has been grouped into the following: (1) 0, 1, 2 (2) 3, 4 (3) 5 (4) 6, 7 and (5) 8, 9, 10.

	Years in Tucson			Age			Education		
Scale	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
0, 1, 2	8	11	9	8	7	13	13	7	8
3, 4	22	19	22	23	19	21	20	20	23
5	24	24	26	24	28	22	26	25	23
6, 7	33	26	24	32	30	22	20	33	31
8, 9, 10	13	20	19	13	16	22	21	15	15
(Respondents)		(1187)			(1187)			(1178)	

	Annual Total Family Income					Sex	
Scale	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
0, 1, 2	13	11	7	8	3	6	13
3, 4	15	20	24	19	15	20	22
5	26	27	24	28	23	22	28
6, 7	25	25	32	25	32	32	23
8, 9, 10	21	17	13	20	27	20	14
(Respondents)			(1037)				(1186)

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

can be compared with the 37% responses for these same scale values by females. This pattern of male/female responses is not unlike those already obtained with earlier questions.

Question 16.

At this point in the survey, after the participants had been asked to consider the possible effects or impacts of fire on forest ecosystems, a question on the potential benefits of a forest fire was posed. Question 16 simply asked the respondent whether or not he or she personally thought that fires ever had any beneficial effects on forests. Those individuals who answered "yes" to this question were then asked to identify what they thought these beneficial effects were.

Over two-thirds of the 1200 survey participants replied that they personally thought fires could have a beneficial effect on forests (Table 29). Only 25% responded in the negative to this question. Of particular interest is the large number of individuals who apparently recognize that fire can play a dual role in natural ecosystems, one destructive and the other beneficial. This ability of the public to differentiate between positive and negative fire effects can be utilized by the forest manager or public information official in establishing citizen awareness programs.

When the data for this question are further evaluated by socio-economic categories significant differences are obtained for both education and sex (Table 30). A much larger percentage of individuals with a high school education felt that fires did not benefit the forest than did those with a college education. A higher level of educational achievement apparently provides a better understanding of the complex role of forest fire and a greater ability to recognize the effects of fire in natural ecosystems. And, again, as evidenced by previous questions, male and

Table 29. Number and percent of respondents who answered (1) yes or (2) no when asked if they thought that fires ever had any beneficial effects on forests.

ANSWER	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	815	67.9
No	300	25.0
Don't Know	85	7.1
Total	1200	100.0

female responses are significantly different. Females tend to be considerably more conservative in their replies than males. Although statistical differences were not detected for the other socioeconomic categories, those individuals who lived over eleven years in Tucson, who were between 30 and 50 years of age, and who had an annual total family income in excess of $15,000 had the highest percentage of affirmative responses regarding the likelihood of beneficial effects from forest fires.

The 815 respondents who did think that fires had some beneficial effects on forests were then asked if they would identify the beneficial effects they had in mind. Since this part of the question was open-ended, as many responses as possible were drawn from the participant through additional probing. The first response given was recorded as the initial response and each succeeding reply, if any, as the second and third responses respectively. These results are presented in Table 31. Over 80% of the initial replies identified the benefits of fire as either clearing or thinning for better growth or clearing away underbrush and debris. It would appear that many respondents regard the clearing and removal of small trees and subsequent reductions in competition and better growth on remaining trees as an important benefit of fire. These responses may also

Table 30. Percentage of respondents in each socioeconomic category who answered (1) yes or (2) no when asked if they thought that fires ever had any beneficial effects on forests.

	Years in Tucson			Age			Education		
Answer	**<5**	**6–11**	**>11**	**<30**	**30–50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Yes	66	66	70	65	71	67	**56**	**72**	**77**
No	26	26	24	29	21	25	**35**	**23**	**16**
Don't Know	8	8	6	6	8	8	**9**	**5**	**7**
(Respondents)		(1200)			(1200)			(1189)	

	Annual Total Family Income					Sex	
Answer	**<5K**	**5–15K**	**15–25K**	**25–50K**	**>50K**	**Male**	**Female**
Yes	58	66	72	73	73	**74**	**61**
No	34	27	23	20	19	**22**	**29**
Don't Know	8	7	5	7	8	**4**	**10**
(Respondents)			(1044)			(1199)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 31. For those 815 respondents who thought that fires did have some beneficial effects on forests, the percent distribution of initial, 2nd, and 3rd responses by categories when asked to describe these beneficial effects.

RESPONSE CATEGORIES	INITIAL RESPONSE	SECOND RESPONSE	THIRD RESPONSE
1. Clearing, thinning for better growth.	48.6%	7.5%	0.8%
2. Clearing away underbrush and debris.	32.2	3.4	-
3. Clearing, thinning for reducing fire danger.	7.1	4.2	0.5
4. Improving soil.	2.8	6.6	0.4
5. Controlling insects and diseases.	2.5	1.5	0.1
6. Improving grazing, better wildlife habitat.	1.0	2.9	0.6
7. Using as a forest fire fighting technique.	0.2	0.7	-
8. Don't Know.	5.0	-	-
9. Other.	0.6	1.0	0.7
10. No Response.	0.0	72.2	96.9
Total	100.0%	100.0%	100.0%

reflect the participant's awareness of dog-hair ponderosa pine thickets in southwestern forests and the knowledge that fire exclusion shares a prime responsibility for maintaining those thickets. The identification of underbrush and debris clearing as an important benefit of fire may relate to an aesthetic or recreational appeal where the participant recognizes that periodic fires in ponderosa pine stands tend to establish an open, park-like appearance. It should be noted that the suggestion of clearing underbrush and debris may have been implanted for some respondents by Question 9 which specifically mentioned "a fire that is burning only underbrush and debris." This prior mention, however, appears not to have had an unduly great influence in that "underbrush and debris clearing" was second in response frequency for Question 16. The beneficial role of fire for hazard and fire danger reduction was offered as the initial response by only 7.1% of the 815 participants.

Nearly 30% of the individuals were able to identify a second benefit of fire, while less than 4% could offer a third response. Although the benefits of fire in clearing and thinning for better growth and fire danger reduction are still strongly identified in the second responses, improvements in soils and grazing for livestock and wildlife also become better defined as possible benefits. The soil improvement benefit is probably associated with the temporary increase in nutrient availability and accelerated plant growth frequently observed following a low intensity fire.

It is apparent from the responses obtained to this question that the general public is indeed aware that fire can have a beneficial effect in the forest. Furthermore, when asked to identify specific fire benefits, many of the responses were closely related to the objectives often presented for prescribed burning programs.

Question 17.

The specific purpose of Question 17 was to determine whether the public was aware of the term "prescribed fire," whether or not they approved of its use, and how they would define the term.

The responses from each participant when asked if he or she had heard of prescribed fire, or controlled burning, are summarized in Table 32. A "yes" answer was obtained from 84.3% of the 1200 respondents, which is an indication that prescribed fire is not a strange or unknown term to the general public in the Tucson area.

Examination of the socioeconomic cross-tabulations for this question continues to show familiar patterns of significance (Table 33). Respondents with higher levels of education and annual incomes account for a significantly greater percentage of "yes" answers than those with lower education and income levels. Significantly more older individuals, particularly between 30 and 50 years of age, have heard of prescribed fire. Although not significant at the 5% level, there is an indication that the longer an individual lives in Tucson, the greater the likelihood that the individual has heard of prescribed fire. There is also a significant

Table 32. Number and percent of respondents who answered (1) yes or (2) no when asked if they had heard of prescribed fire or controlled burning.

ANSWER	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	1011	84.3
No	167	13.9
Don't Know	22	1.8
Total	1200	100.0

Table 33. Percentage of respondents in each socioeconomic category who answered (1) yes or (2) no when asked if they had heard of prescribed fire or controlled burning.

	Years in Tucson			Age			Education		
Answer	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
Yes	80	86	87	77	**91**	86	78	86	**91**
No	18	12	12	**21**	8	13	**20**	13	8
Dont't Know	2	2	1	2	1	1	2	1	1
(Respondents)		(1197)			(1197)			(1188)	

	Annual Total Family Income					Sex	
Answer	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
Yes	76	84	84	**91**	**92**	**90**	79
No	**22**	15	14	7	8	9	**19**
Don't Know	2	1	2	2	0	1	2
(Respondents)			(1042)			(1196)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

difference between the 90% of males who have heard of prescribed fire and the 79% for females.

If respondents answered "yes" to the question whether they had heard of prescribed fire, the interviewer immediately asked if they approved or disapproved of the practice and how they would personally define prescribed fire. Respondents who had not heard of prescribed fire or who gave a "don't know" answer to the inquiry were taken directly to Question 18.

As already noted, 1011 participants indicated that they had heard of prescribed fire or controlled burning. The number and percentage of this group that approved or disapproved of this practice are shown in Table 34. Over 80%, or 810 individuals, approved of prescribed fire, less than 6% disapproved, and 14% were unable to commit themselves. These data indicate that those individuals who have heard of prescribed fire would also approve its use as a management tool. Therefore, it would appear that public acceptance of a prescribed fire program could be enhanced considerably by a publicity or educational campaign which explains the possible uses and benefits of prescribed fire.

A further breakdown of these responses into socioeconomic categories is presented in Table 35. Significant differences were obtained for cross-

Table 34. For those 1011 respondents who had heard of prescribed fire, the number and percent who (1) approved or (2) disapproved of the practice.

RESPONSE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Approve	810	80.1
Disapprove	59	5.8
Don't Know	142	14.1
Total	1011	100.0

tabulations with age, annual total family income and sex. Strong approval responses for prescribed fire were obtained from individuals over 30 years of age. Participants under 30 years did not voice strong disapproval but their responses reflected a high percentage of "don't know" answers. Response distribution patterns similar to the older age classes can also be observed for males and individuals with an annual income between $25,000 and $50,000. It is interesting to note that when approval or disapproval of prescribed fire is cross-tabulated with the three levels of education, the chi-square test at 5% is not significant. Table 33, for example, shows that a high percentage of college graduates have heard of prescribed fire, whereas, Table 35 indicates approval or disapproval of its use by this group at a percentage which is close to the overall mean. Also, no significance was obtained for the years of residency in Tucson; however, it appears that longer residency times are related to a stronger approval rate for the use of prescribed fire.

No matter what their response for the approval or disapproval of prescribed fire, each of the 1011 participants who had heard of prescribed fire was asked to define such a fire in their own words. Following the initial response, the interviewer tried to obtain additional definitions through continued probing.

The two most common definitions or descriptions of prescribed fire offered by the respondents were related to the clearing of underbrush and debris and the fact that such a fire was watched or supervised (Table 36). A substantial number of participants also identified a prescribed fire as being limited to a certain area or a fire which clears and thins forests for better growth. Many of these responses are similar to those presented in Table 31 which summarized the possible beneficial effects of fire in forests. Although nearly 50% of the respondents were able to offer a

Table 35. For those 1011 respondents who had heard of prescribed fire, the percentage in each socioeconomic category who (1) approved or (2) disapproved of the practice.

	Years in Tucson			Age			Education		
Response	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
Approve	75	82	83	73	82	85	78	82	80
Disapprove	6	6	5	8	5	5	7	5	5
Don't Know	19	12	12	19	13	10	15	13	15
(Respondents)		(1011)			(1011)			(1005)	

	Annual Total Family Income					Sex	
Response	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
Approve	71	77	80	86	77	85	75
Disapprove	9	7	5	3	12	5	6
Don't Know	20	16	15	11	11	10	19
(Respondents)			(892)			(1010)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 36. For those 1011 respondents who had heard of prescribed fire, the percent distribution of initial, 2nd, and 3rd responses by categories when asked to define prescribed fire.

RESPONSE CATEGORIES	INITIAL RESPONSE	SECOND RESPONSE	THIRD RESPONSE
1. Fire which clears underbrush and debris.	18.6%	9.4%	1.8%
2. Fire which is supervised, watched, controlled.	16.8	11.7	3.3
3. Fire which is limited to a certain area.	14.0	4.9	1.0
4. Fire which clears and thins forest for better growth.	12.3	6.2	0.9
5. Fire set by someone with authority.	11.7	3.9	0.6
6. Fire which clears and thins forest to reduce fire danger.	9.4	3.9	1.3
7. Fire which is needed for some purpose.	3.2	4.3	1.6
8. Fire used to fight another fire.	2.2	0.2	-
9. Fire caused by lightning which is allowed to burn.	0.7	-	-
10. Fire used to improve grazing.	0.6	0.5	-
11. Fire used to control insects and diseases.	0.5	0.9	0.3
12. Don't Know.	8.5	-	-
13. Other.	1.5	1.8	0.8
14. No response.	0.0	52.3	88.4
Total	100.0%	100.0%	100.0%

second description of prescribed fire, there was not a large amount of variation from the initial responses. It would appear, then, that the public perception of prescribed fire is a fire which results in some removal of underbrush, debris, and small trees in a forest, is under the control or supervision of some authority, and is confined to a limited area. Again, there may have been some influence exerted here from the identification of a fire "burning only underbrush and debris" in Question 9.

Question 18.

In Question 18 the participant was asked whether he or she strongly agreed, agreed, disagreed, or strongly disagreed with a series of statements concerning fires in pine forests. The first four statements were specifically related to fires which were already burning in pine forests and whether they should be allowed to burn as long as they were watched. The first statement simply indicated that fires already burning should be allowed to continue burning, if watched, while the second, third, and fourth statements further qualified the fire condition by relating to fires burning underbrush and debris, those started by lightning, and those started by human carelessness, respectively. The fifth statement, which was the opposite from the first, requested a response to the declaration that no fires should be allowed to burn in pine forests.

The percent responses to each of the five statements are summarized in Table 37. Every survey participant was asked to respond to each statement so that the table values reflect percentages based upon a total of 1200 responses for each statement.

The results show a strong consensus among the respondents that those fires already burning in pine forests and those fires started by lightning should **not** be allowed to burn even if they are watched (69.3% and 71.2%,

respectively). There is an even greater feeling that fires started by human carelessness should **not** be allowed to burn even if they are watched (86%). The higher public tolerance of letting lightning fires burn in comparison to those started by human carelessness is not unexpected and is probably reflective of a public feeling that nature should be allowed to take its course. On the other hand, the large percentage of respondents (57.3%) who agreed or strongly agreed that fires burning underbrush and debris, but not the tall trees in a pine forest, **should** be allowed to burn as long as they were watched is somewhat surprising. Since this was the only statement out of the five which gave the participants some indication

Table 37. Percent of 1200 respondents who (1) strongly agree (2) agree (3) disagree or (4) strongly disagree with five statements regarding whether fires already burning in pine forests should be allowed to burn as long as they are watched.

STATEMENT	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE	DON'T KNOW	TOTAL
1. Fires already burning should be allowed to burn if watched.	1.3	18.6	55.0	14.3	10.8	100.0%
2. Fires burning underbrush and debris, not tall trees, should be allowed to burn if watched.	5.5	51.8	29.4	4.1	9.2	100.0%
3. Fires started by lightning should be allowed to burn if watched.	2.0	18.1	58.2	13.0	8.7	100.0%
4. Fires started by human carelessness should be allowed to burn if watched.	0.7	6.5	57.5	28.5	6.8	100.0%
5. No fires should be allowed to burn in pine forests.	4.9	30.0	50.5	5.6	9.0	100.0%

of fire severity, individuals may have felt more comfortable in expressing agreement. If the respondents were relating their feelings regarding the acceptance of fire in pine forests to the amount of damage which they perceive a fire will do, the second statement of fires burning underbrush and debris would imply a minimal amount of damage. The first, third, and fourth statements gave no indication of fire severity, consequently, responses are much more conservative and replies of disagreement are increased.

The fifth statement, that no fires should be allowed to burn in pine forests, received over 55% strongly disagree and disagree responses. Even without any indication of fire severity in this question, it is evident that the public would accept the presence of fire in pine forests.

The cross-tabulations of socioeconomic categories with each of the five statements are presented in Tables 38 through 42. Percent values shown in those tables can be compared with the percent response distribution for all 1200 participants which appears in Table 37.

Table 38 depicts the cross-tabulation results of socioeconomic categories for the statement that fires already burning in pine forests should be allowed to burn as long as they are watched. The only category detected to be statistically significant at the 5% level was age, where the participants in the 30- to 50- year old group offered a higher percentage of "agree" responses and fewer "disagree" or "strongly disagree" replies than did those under 30 or over 50 years of age. Although some trends can be observed in the other four socioeconomic categories, the variations are not large enough to be significant at 5%.

The categories of age, education, and sex were all significantly different when cross-tabulated with the responses for the second statement

Table 38. Percentage of respondents in each socioeconomic category who (1) strongly agree (2) agree (3) disagree or (4) strongly disagree with the statement that fires already burning in pine forests should be allowed to burn as long as they are watched.

	Years in Tucson			Age			Education		
Response	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
Strongly Agree	1	1	2	1	1	2	1	1	2
Agree	18	19	19	19	22	16	16	19	20
Disagree	52	58	56	56	52	57	59	55	52
Strongly Disagree	16	12	14	17	12	14	15	17	12
Don't Know	13	10	9	7	13	11	9	8	14
(Respondents)		(1195)			(1195)			(1186)	

	Annual Total Family Income					Sex	
Response	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
Strongly Agree	0	3	1	1	2	2	1
Agree	22	17	22	18	19	21	16
Disagree	61	52	56	55	56	54	56
Strongly Disagree	12	15	12	16	13	13	16
Don't Know	5	13	9	10	10	10	11
(Respondents)			(1040)			(1194)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 39. Percentage of respondents in each socioeconomic category who (1) strongly agree (2) agree (3) disagree or (4) strongly disagree with the statement that fires already burning underbrush and debris in pine forests, but not tall trees, should be allowed to burn as long as they are watched.

	Years in Tucson			Age			Education		
Response	**<5**	**6–11**	**>11**	**<30**	**30–50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Strongly Agree	6	5	6	6	7	4	3	6	8
Agree	48	53	54	42	55	60	49	53	54
Disagree	34	31	26	41	24	23	34	31	23
Strongly Disagree	3	4	5	6	4	3	5	4	3
Don't Know	9	7	9	5	10	10	9	6	12
(Respondents)		(1195)			(1195)			(1186)	

	Annual Total Family Income					Sex	
Response	**<5K**	**5–15K**	**15–25K**	**25–50K**	**>50K**	**Male**	**Female**
Strongly Agree	2	7	6	7	3	8	3
Agree	47	51	53	57	50	53	51
Disagree	36	28	31	26	34	29	30
Strongly Disagree	4	5	3	3	3	4	4
Don't Know	11	9	7	7	10	6	12
(Respondents)			(1040)				(1194)

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

(Table 39). This statement, which dealt with fires already burning in underbrush and debris, received significantly higher percentages of strongly agree and agree responses with increasing age and higher education. This age - education response pattern, already detected in earlier questions, could be a reflection of additional experience and knowledge of natural phenomena associated with greater age and education levels. The above normal percent of "don't know" responses by college graduates is somewhat puzzling. This pattern for college graduates prevails for all five cross-tabulation tables for this question. Sixty-one percent of the males in the survey either strongly agreed or agreed with the statement of allowing fires burning underbrush and debris to continue as compared to 54% for females.

The same socioeconomic categories of age, education, and sex were also detected to be statistically significant for the third statement dealing with fires which were started by lightning (Table 40). A greater percent of individuals in the 30- to 50- year-old group either strongly agreed or agreed that these lightning fires should be allowed to burn if watched than did those individuals under 30 and over 50 years of age. This could be an expression of conservatism on the part of the latter two age groups or more familiarity with lightning fires by the 30- to 50- year olds. The differences between educational levels were quite pronounced. College graduates offered a much higher percentage of strongly agree and agree responses to allowing lightning fires to continue burning (29%) than either high school graduates (13%) or those with some college training (19%). An increased understanding of fire effects and of the size and intensity of most lightning fires by college graduates may be reflected in these results. Male and female comparisons for this third statement continue to show males responding with a significantly higher percentage of agree answers.

Table 40. Percentage of respondents in each socioeconomic category who (1) strongly agree (2) agree (3) disagree or (4) strongly disagree with the statement that fires already burning in pine forests which were started by lightning should be allowed to burn as long as they are watched.

	Years in Tucson			Age			Education		
Response	**<5**	**6-11**	**>11**	**<30**	**30-50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Strongly Agree	2	1	2	**2**	**3**	**1**	**1**	**2**	**3**
Agree	19	21	17	**17**	**21**	**16**	**12**	**17**	**26**
Disagree	57	54	61	**59**	**53**	**64**	**63**	**61**	**52**
Strongly Disagree	14	15	12	**17**	**12**	**10**	**15**	**14**	**9**
Don't Know	8	9	8	**5**	**11**	**9**	**9**	**6**	**10**
(Respondents)		(1195)			(1195)			(1186)	

	Annual Total Family Income					Sex	
Response	**<5K**	**5-15K**	**15-25K**	**25-50K**	**>50K**	**Male**	**Female**
Strongly Agree	1	2	2	2	0	**2**	**2**
Agree	22	21	19	18	18	**22**	**15**
Disagree	56	57	59	58	63	**56**	**60**
Strongly Disagree	11	13	12	14	11	**13**	**13**
Don't Know	10	7	8	8	8	**7**	**10**
(Respondents)			(1040)				(1194)

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Based on the fact that the fourth statement, which is related to fires started by human carelessness, differs from the third only in the cause of ignition, it could be expected that the cross-tabulations of responses with socioeconomic categories for the two statements (Table 40 and 41) would be similar. And, indeed, the response patterns and significance detected for age and sex in both tables correspond quite closely. In particular, males and those individuals between 30 and 50 years of age offered a higher percentage of agree responses to both statements than either females or the two other age classes. However, an important difference between the two tables is that no significant cross-tabulation differences were detected between the education levels in Table 41 as there were in Table 40. It would appear that the educational backgrounds of the participants which influenced the responses for allowing lightning-caused fires to continue burning (Table 40) were not an issue when fires caused by human carelessness were considered. In other words, high school graduates, those with some college training, and college graduates offered responses to the statement of allowing fires started by human carelessness to burn which did not differ significantly from one to another. Human carelessness apparently elicits a similar response regardless of educational background, whereas allowing lightning-caused fires to burn would imply some knowledge of lightning and its effects, hence the significance in educational levels in Table 40.

When the cross-tabulations for the fifth statement, that no fires should be allowed to burn in pine forests, are examined, age, education, and sex again show significant differences (Table 42). For age, the 30- to 50-year-old group differs from the under 30- and over 50-year groups. Individuals in this middle age group appear to be considerably more tolerant of allowing fires to burn in pine forests. This trend in fire toler-

Table 41. Percentage of respondents in each socioeconomic category who (1) strongly agree (2) agree (3) disagree or (4) strongly disagree with the statement that fires already burning in pine forests which were started by human carelessness should be allowed to burn as long as they are watched.

	Years in Tucson			Age			Education		
Response	**<5**	**6–11**	**>11**	**<30**	**30–50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Strongly Agree	1	1	0	**1**	**1**	**0**	0	1	0
Agree	6	8	7	**5**	**10**	**6**	6	7	8
Disagree	56	59	58	**50**	**56**	**66**	60	58	54
Strongly Disagree	29	26	29	**40**	**24**	**21**	28	29	29
Don't Know	8	6	6	**4**	**9**	**7**	6	5	9
(Respondents)		(1198)			(1198)			(1187)	

	Annual Total Family Income					Sex	
Response	**<5K**	**5–15K**	**15–25K**	**25–50K**	**>50K**	**Male**	**Female**
Strongly Agree	0	1	0	0	1	**1**	**1**
Agree	7	7	6	8	5	**10**	**3**
Disagree	65	59	57	56	63	**55**	**60**
Strongly Disagree	23	28	29	29	21	**27**	**30**
Don't Know	5	5	8	7	10	**7**	**6**
(Respondents)			(1042)			(1197)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 42. Percentage of respondents in each socioeconomic category who (1) strongly agree (2) agree (3) disagree or (4) strongly disagree with th statement that no fires should be allowed to burn in pine forests.

	Years in Tucson			Age			Education		
Response	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Strongly Agree	6	5	4	7	3	4	5	6	3
Agree	33	34	27	33	26	31	42	27	20
Disagree	47	47	55	48	55	50	41	54	59
Strongly Disagree	4	5	6	6	7	4	3	6	8
Don't Know	10	9	8	6	9	11	9	7	10
(Respondents)		(1196)			(1196)			(1187)	

	Annual Total Family Income					Sex	
Response	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Strongly Agree	5	6	5	4	3	4	6
Agree	35	35	28	26	30	30	30
Disagree	47	47	54	56	52	54	48
Strongly Disagree	4	4	6	7	5	7	4
Don't Know	9	8	7	7	10	5	12
(Respondents)			(1040)			(1195)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

ance is even more dramatic with increasing levels of education. Two thirds of the respondents with college educations either strongly disagreed or disagreed with the statement that no fires should be allowed to burn in pine forests, whereas only 44% of those with only high school training offered the same responses. Although approximately one-third of both males and females agreed or strongly agreed that no fires should be allowed to burn in pine forests, there was a significant difference in the percent of males who disagreed or strongly disagreed with the statement (61%) as compared to females (52%).

The two socioeconomic categories which did not show any significant differences for any of the five statements were years in Tucson and annual total family income. Although several trends can be detected in some of the tables for these two categories the responses were consistent enough not to allow detection of significance at the 5% level. The use of five income groups also increased the number of degrees of freedom used in testing the chi-square statistic for annual total family income which may have reduced test sensitivity in that category.

Question 19.

Question 19 sought to evaluate the degree of public knowledge regarding the role of fire in hazard or fuel reduction. Each respondent was asked whether he or she agreed or disagreed with the statement that severe fires are less likely to occur in pine forests that have had occasional underbrush fires. The overall results, shown in Table 43, indicate that nearly two-thirds of the 1200 survey participants agreed with the above statement, while only 15.8% disagreed and 19.6% were unable to respond with a definite answer. By this time in the administration of the questionnaire, it would appear that respondents had become partially instructed

regarding some benefits of prescribed or controlled burning. While 64.6% agreed that future fire danger would be reduced in Question 19, only 11.8% of 815 respondents specifically identified fire danger reduction as a benefit in Question 16, or 8% of the total 1200 survey participants. Approximately 70% of the total sample did identify clearing, for one purpose or another, as a fire benefit in Question 16, and the percentage of "agree" answers to Question 19 corresponded closely with the responses to the same question by the comparison group tested by Taylor and Daniel (1982). It is possible that the success of a campaign to gain public support for a prescribed burning program could be enhanced if focus is placed on the fuel reduction benefits of fire.

Socioeconomic cross-tabulations for this question show significant differences for age, education, and sex (Table 44). The real difference in the age category occurs with those participants over 50 years of age. These individuals not only had the lowest percentage of "disagree" answers, but also the highest percent value of "don't know" responses. The influence of educational levels is even more prominent. Participants with college degrees offered substantially more "agree" and fewer "disagree" and

Table 43. Number and percent of respondents who (1) agreed or (2) disagreed with the statement that severe fires are less likely to in pine forests that have had occasional underbrush fires.

ANSWER	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Agree	775	64.6
Disagree	189	15.8
Don't Know	236	19.6
Total	1200	100.0

Table 44. Percentage of respondents in each socioeconomic category who (1) agreed or (2) disagreed with the statement that severe fires are less likely to occur in pine forests that have had occasional underbrush fires.

	Years in Tucson			Age			Education		
Response	**<5**	**6–11**	**>11**	**<30**	**30–50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Agree	63	62	67	**65**	**66**	**64**	**58**	**67**	**71**
Disagree	14	20	16	**17**	**18**	**12**	**19**	**15**	**13**
Don't Know	23	18	17	**18**	**16**	**24**	**23**	**18**	**16**
(Respondents)		(1194)			(1194)			(1186)	

	Annual Total Family Income					Sex	
Importance	**<5K**	**5–15K**	**15–25K**	**25–50K**	**>50K**	**Male**	**Female**
Agree	57	62	66	70	67	**71**	**58**
Disagree	12	19	17	14	12	**18**	**14**
Don't Know	31	19	17	16	21	**11**	**28**
(Respondents)			(1039)				(1193)

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

"don't know" responses than did those with high school educations. It would appear that the greater "agree" responses for college graduates reflects a greater basic knowledge and understanding of the role of fire by that group of participants. The third significant category, sex, continued the established pattern of females offering more conservative responses than males. Only 58% of the females agreed with the statement that periodic fires would likely reduce the occurrence of future severe fires while 71% of the males interviewed were able to agree with the statement. A large percent difference can also be noted for "don't know" responses, where males had 11% and females 28%.

Question 20.

Question 20 directly asked each survey participant whether he or she thought that forest managers should or should not periodically burn underbrush and debris in pine forests. No attempt was made to identify a possible benefit of such a periodic burn, but, because of the previous question relating to fuels reduction, it is quite likely that many respondents had the removal of hazardous fuels in mind when answering. In fact, the overall results for Question 20 (Table 45) are not too different from

Table 45. Number and percent of respondents who thought that forest managers (1) should or (2) should not periodically burn underbrush and debris in pine forests.

ANSWER	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Should Burn	805	67.1
Should Not Burn	180	15.0
Don't Know	215	17.9
Total	1200	100.0

those for Question 19 (Table 43). Again, approximately two-thirds of the respondents thought that forest managers should periodically burn underbrush and debris in pine forests, while only 15% felt that these fires should not take place, and 17.9% did not know or were unable to respond to the question. These results would imply that the general public would support a periodic burning program by forest managers in pine forests.

The results of cross-tabulating socioeconomic categories with responses to this question are presented in Table 46. It is interesting to note that this is one of the few times in the survey when all five socioeconomic categories showed significant differences at the 5% probability level for a question. The respondents who thought that forest managers should periodically burn underbrush and debris in pine forests could be characterized as males having lived in Tucson for more than five years, being between 30 and 50 years of age, having some college education or a college degree, and earning between $25,000 and $50,000 annual total family income. Those survey participants who thought that pine forests should not be burned periodically or did not know how to respond to the question included women, those with less than five years residency in Tucson, less than 30 years of age, an education terminating with high school, and low annual family income. It is possible that short-term residents of Tucson are new arrivals from the northeast or mid-west where the use of fire in forest management is not extensively practiced. These individuals may not yet be aware of the increasing importance of fire in western forest ecosystems. Although younger age, lower educational achievement, and smaller annual total family income may all be interrelated, these categories, for some reason, show a high degree of conservatism. Possibly a lack of knowledge on the potential benefits of fire due to age and

Table 46. Percentage of respondents in each socioeconomic category who thought that forest managers (1) should or (2) should not periodically burn underbrush and debris in pine forests.

	Years In Tucson			Age			Education		
Response	**<5**	**6–11**	**>11**	**<30**	**30–50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Should Burn	**60**	**72**	**71**	**65**	**72**	**67**	**58**	**75**	**70**
Should Not Burn	**18**	**15**	**13**	**20**	**12**	**13**	**21**	**12**	**12**
Don't Know	**22**	**13**	**16**	**15**	**16**	**20**	**21**	**13**	**18**
(Respondents)		(1193)			(1193)			(1185)	

	Annual Total Family Income					Sex	
Response	**<5K**	**5–15K**	**15–25K**	**25–50K**	**>50K**	**Male**	**Female**
Should Burn	**50**	**64**	**71**	**78**	**72**	**72**	**63**
Should Not Burn	**22**	**20**	**13**	**9**	**13**	**17**	**13**
Don't Know	**28**	**16**	**16**	**13**	**15**	**11**	**24**
(Respondents)			(1040)			(1192)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

education coupled by a carry-over of environmentalism from the early 1970's may be becoming evident in some of these responses.

Question 21.

Question 21 was structured so that the interviewer provided the participant with some information on differentiating between low and high intensity forest fires before a response was solicited. In contrast, many of the earlier survey questions attempted to assess the participant's level of knowledge of forest fire and fire effects and to determine the degree of importance and agreement each participant felt for certain activities involving fire in pine forests. Question 21 stated directly that there are two extremes in forest fires. On the one hand, a high intensity forest fire can travel rapidly, release a large amount of heat and flames, and consume everything in its path, while, on the other hand, fires of low intensity travel slowly, release a small amount of heat and flames, and burn only leaves, branches, and debris on the surface of the ground. The question further stated that some forest managers claim that the low heat and flame fires can be beneficial while other forest managers say that all fires are harmful.

The first part of this multi-staged question asked the participant whether he or she had heard of this issue that low intensity forest fires can be beneficial versus all forest fires are harmful. The responses for all 1200 survey participants, shown in Table 47, indicate that only 325, or 27.1%, had heard of this issue. A much larger percentage, 69.6%, had not heard while just 3.3% responded with a "don't know." The small number of "yes" answers to this question is somewhat surprising in light of many of the earlier questions where the participants demonstrated a considerable amount of knowledge about fire effects and the potential benefits of fire.

Table 47. Number and percent of respondents who answered (1) yes or (2) no when asked if they had heard of the issue that some forest managers claim low heat and flame fires can be beneficial while other forest managers say all fires are harmful.

ANSWER	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	325	27.1
No	835	69.6
Don't Know	40	3.3
Total	1200	100.0

For example, the distribution of responses to Question 15, which asked for a personal ranking of knowledge about the effects of forest fires, showed that the general public considers itself above average in fire knowledge. Also in Question 17, 84.3% of the 1200 respondents stated that they had heard of prescribed fire or controlled burning. A possible explanation for the large number of "no" responses to Question 21 may be the result of many participants not having heard forest managers, or other resource management professionals, actually state that all fires are harmful. Other than the publicity normally issued for partial or full closures of selected forested areas and bans on open campfires during periods of high fire danger, the general public is not exposed to a large amount of fire restrictions in forests. On the other hand, attempts are made by federal and state land management agencies to adequately inform the public prior to and during prescribed or natural fire activities. It is quite possible, then, that many survey participants did not consider the issue of low intensity fires being beneficial versus all fires being harmful to be an issue at all. There would appear to be an overall recognition that, although some fires of high intensity are harmful to forests, the statement that all fires are harmful may not be widely accepted by the public.

The socioeconomic cross-tabulations for the responses to this issue question are presented in Table 48. Significance at the 5% level is again detected for age, education, and sex. Respondents who are thirty years of age and older, possess a college education, and are males represented the highest percentage of participants who had heard of the previously mentioned issue. Years in Tucson and annual total family income were not statistically significant, although a trend of a greater number of "yes" responses with increased income did appear.

The 325 respondents who had heard of the issue were then asked if the issue was important to each of them personally. Of this number 226, or 69.5%, indicated that it was important, 86 (26.5%) responded that it was not important, while the remaining 13 (4.0%) indicated that they did not know (Table 49). The strong degree of importance placed on this issue by the participants is an additional indication of the public interest and concern for forest resources and fire effects.

Cross-tabulation data of socioeconomic categories with whether or not the issue was important for these 325 respondents are given in Table 50. The only category for which a significant difference was obtained was sex, where more males felt the issue was important than did females.

The 226 survey participants, who had both heard of the issue of low intensity fires being beneficial versus all fires being harmful and who indicated that the issue was personally important to them, were asked to rank the degree of importance which they placed on this issue on a scale of 0 to 10 where 0 was not very important and 10 extremely important. These results are presented in Table 51. There is little doubt that these participants placed a high degree of importance on this issue when the 79.2% responses recorded for the 5 highest values (6 through 10) are compared with the 5.8% responses for the 5 lowest values (0 through 4).

Table 48. Percentage of respondents in each socioeconomic category who answered (1) yes or (2) no when asked if they had heard of the issue that some forest managers claim low heat and flame fires can be beneficial while other fores managers say all fires are harmful.

	Years In Tucson			Age			Education		
Answer	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Yes	27	27	27	23	29	30	19	28	36
No	71	68	70	74	70	65	76	70	63
Don't Know	2	5	3	3	1	5	5	2	1
(Respondents)		(1197)			(1197)			(1188)	

	Annual Total Family Income					Sex	
Answer	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Yes	21	26	25	32	33	32	22
No	74	70	72	67	67	65	74
Don't Know	5	4	3	1	0	3	4
(Respondents)			(1042)			(1196)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 49. For those 325 respondents who had heard of the issue that there are beneficial and harmful extremes in forest fires, the number and percent who indicated that the issue was (1) important or (2) not important to them personally.

IMPORTANCE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Important	226	69.5
Not Important	86	26.5
Don't Know	13	4.0
Total	325	100.0

Additional information was also obtained from the 835 respondents who answered "no" and the 40 who responded with a "don't know" when asked if they had heard of the issue that low intensity forest fires can be beneficial versus all forest fires are harmful. These 875 participants were asked, even if they had not heard or did not know of the issue, whether it was still important to them. Nearly sixty percent (515) responded that the issue was, indeed, personally important (Table 52). Less than a third of these 875 individuals (270) indicated that the issue was not important and only 10% (90) were not able to offer a response.

The cross-tabulations of these results with socioeconomic categories identified age as the only category showing significant differences (Table 53). A larger percentage of respondents less than thirty years of age felt that the issue was more important to them personally than did those over fifty years old. The over fifty age group also had a high percent of "don't know" responses when compared with the under 30 age group. Even though they had not heard of the issue under discussion, it would appear that the younger respondents were still very concerned about the beneficial or harmful effects of forest fires. It is interesting to note that the

Table 50. For those 325 respondents who had heard of the issue that there are beneficial and harmful extremes in forest fires, the percentage in each socioeconomic category who indicated that the issue was (1) important or (2) not important to them personally.

	Years In Tucson			Age			Education		
Importance	**<5**	**6–11**	**>11**	**<30**	**30–50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Important	67	64	73	70	65	73	69	70	69
Not Important	27	36	23	28	31	21	25	26	28
Don't Know	6	0	4	2	4	6	6	4	3
(Respondents)		(325)			(325)			(322)	

	Annual Total Family Income					Sex	
Importance	**<5K**	**5–15K**	**15–25K**	**25–50K**	**>50K**	**Male**	**Female**
Important	75	68	72	65	71	**72**	**66**
Not Important	19	31	21	32	24	**26**	**26**
Don't Know	6	1	7	3	5	**2**	**8**
(Respondents)			(284)			(325)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 51. For those 226 respondents who had heard of the two extremes in forest fires and who indicated that the issue was important to them personally, the number and percent who ranked the importance of this issue on a scale of 0 to 10 where 0 is not very important and 10 extremely important.

SCALE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
0	2	0.9
1	2	0.9
2	1	0.4
3	2	0.9
4	6	2.7
5	29	12.8
6	25	11.1
7	28	12.4
8	54	23.9
9	20	8.8
10	52	23.0
No Response	5	2.2
Total	226	100.0

Table 52. For those 875 respondents who had not heard or did not know of the issue that there are beneficial and harmful extremes in forest fires, the number and percent who indicated that the issue was still (1) important or (2) not important to them personally.

IMPORTANCE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Important	515	58.9
Not Important	270	30.8
Don't Know	90	10.3
Total	875	100.0

Table 53. For those 875 respondents who had not heard or did not know of the issue that there are beneficial and harmful extremes in forest fires, the percentage in each socioeconomic category who indicted that the issue was still (1) important or (2) not important to them personally.

	Years In Tucson			Age			Education		
Importance	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Important	59	57	60	64	58	54	58	60	60
Not Important	30	36	30	29	31	33	29	32	31
Don't Know	11	7	10	7	11	13	13	8	9
(Respondents)		(872)			(872)			(865)	

	Annual Total Family Income					Sex	
Importance	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Important	60	59	60	59	72	61	58
Not Important	29	31	30	33	26	31	30
Don't Know	11	10	10	8	2	8	12
(Respondents)			(759)			(871)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

other socioeconomic categories, particularly education and sex, did not show significant chi-square differences.

To conclude Question 21, the 515 participants who had not heard or did not know of the issue but indicated that it was personally important were asked to rank the degree of this importance on a scale of 0 to 10 where 0 was not very important and 10 extremely important. The results of this ranking, shown in Table 54, are quite similar to the rankings obtained for the 226 respondents who had heard of the issue and considered it to be

Table 54. For those 515 respondents who had not heard or did not know of the two extremes in forest fires and who indicated that the issue was still important to them personally, the number and percent who ranked the importance of this issue on a scale of 0 to 10 where 0 is not very important and 10 extremely important.

SCALE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
0	0	0.0
1	3	0.6
2	5	1.0
3	11	2.1
4	19	3.7
5	74	14.4
6	57	11.1
7	76	14.8
8	111	21.5
9	37	7.2
10	113	21.9
No Response	9	1.7
Total	515	100.0

personally important (Table 51). The 76.5 percent of responses in the 5 highest values for importance (values 6 through 10) in Table 54 is not much different from the 79.2 percent evident for the same values in Table 51.

It would appear that whether or not the respondents had heard of the issue that some forest managers claim that low heat and flames fires can be beneficial while other forest managers say that all fires are harmful, a large number consider the issue not only to be personally important, but also important to a fairly high degree. This supports earlier findings that the general public is concerned about fires and places a great deal of importance on their presence in forest ecosystems.

Question 22.

In Question 22 the survey participants were asked whether or not they thought that a low heat and flame fire would result in certain ecosystem changes. The statements relating to the possible impact of such a low intensity fire included reducing the potential for future, large fires; controlling brush and shrubs; increasing water supplies; increasing grazing; reducing dead, woody fuels; and controlling insects and diseases. All six statements were presented to each of the 1200 respondents.

The purpose of this question was to determine whether the public recognized some of the potential benefits of a low intensity fire. Earlier questions, specifically numbers 10 through 13, dealt with the potential impacts of a rapidly moving, intense wildfire. Question 21, which immediately preceded this one, attempted to educate the public that fires of low intensity could produce ecosystem changes quite different from those associated with high intensity fires.

The overall responses for the six statements in Question 22 are presented in Table 55. A very high percentage of the respondents thought

Table 55. Percent of 1200 respondents who thought that a low heat and flame fire (1) would or (2) would not do the following:

STATEMENT	WOULD	WOULD NOT	DON'T KNOW	TOTAL
1. Reduce the potential for future large, intense fires.	74.8	10.3	14.9	100.0
2. Control amounts of brush and shrubs.	86.3	5.7	8.0	100.0
3. Increase water supplies.	21.8	40.9	37.3	100.0
4. Increase grazing areas.	50.7	27.1	22.2	100.0
5. Reduce dead woody material on the ground.	89.2	5.2	5.6	100.0
6. Control forest insects and diseases.	58.9	16.0	25.1	100.0

that a low heat and flame fire would reduce dead, woody material on the ground and would control the amounts of brush and shrubs. These results may reflect a recognition by the public that the most likely source of fuel for a low intensity forest fire is the dead, woody material on the ground and brush or shrubs. In addition, some of the participants may be aware that an important objective of prescribed burning in forests is to reduce hazards or fuels, while fire is also used in range management to control the invasion of brush and shrubs. Nearly three-fourths of the respondents felt that a low intensity fire would reduce the potential for future large, intense fires. Although this question is closely related to the reduction of dead, woody material, since the removal of combustible fuels will leave less material for future fires, the vagueness associated with the words "potential" and "future" may have created some indecision in the responses.

Some individuals may have felt that a low intensity fire would reduce the potential of a future, large fire for several years, but if another low intensity fire did not occur for some time, fuels can accumulate and create another potential large fire situation.

The two statements relating the impacts of a low intensity fire to increasing grazing areas and controlling forest insects and diseases resulted in 50.7% and 58.9% affirmative responses respectively. The percentage of responses stating that a low intensity fire would increase grazing areas is somewhat low when compared with the percent of respondents who thought that such a fire would control brush and shrubs. Although it is possible that some participants were not able to recognize that controlling brush and shrubs by fire frequently results in better grazing, the statement of increasing grazing areas may have caused hesitancy. Had it been stated that grazing would be improved instead of increased in area following a low intensity fire, the percent of affirmative responses might have been higher.

The only statement where respondents thought that a low heat and flame fire would not cause a particular change is in increasing water supplies. In fact, both the percentage of "would not" and "don't know" responses both exceeded the percentage of "would" responses for this question. It is possible that the general public feels a low intensity fire which does not remove large, water-using overstory vegetation will not result in increased water yields. The very large number of participants who responded with a "don't know" answer also is significant, since it indicates a degree of uncertainty about the role of low intensity fires in watershed hydrology.

The responses to each of the six statements concerning the changes resulting from a low heat and flame fire were cross-tabulated with the

socioeconomic categories. These cross-tabulations are presented in Tables 56 through 61.

The one category which showed a significant chi-square difference at the 5% level for all six statements was age. In most cases, this difference can be attributed to a shift of "would" responses for the older age groups, 30 to 50 years and over 50 years, to "don't know." The older respondents appeared to be reluctant to offer a definitive "would" or "would not" response, and opted, instead, for the "don't know" answer. Whether this response pattern for older participants is actually indicative of a lack of knowledge, a high degree of conservatism, or some other factor is unknown. It is also difficult to explain why such a large percentage of respondents over fifty years of age thought that a low heat and flame fire would cause an increase in grazing areas (Table 59).

With the exception of the statement relating to the reduction of dead, woody material on the ground (Table 60), each of the other five statements showed a significant difference for males and females. Again, the results reflect a change from "would" responses to "don't know" for females.

Education proved to be a significant factor in all three of the statements which had received the highest percentage of "would" responses. These statements were that a low heat and flame fire would (1) reduce dead, woody material on the ground (Table 60), (2) control the amount of brush and shrubs (Table 57), and (3) reduce the potential for future large, intense fires (Table 56). Those participants with some college education or a college degree had a significantly higher percentage of "would" responses than those with only a high school education. Since these three statements also relate to the reasons why fire is often used as a prescribed management tool in forestry and range management, it is possible

Table 56. Percentage of respondents in each socioeconomic category who thought that a low heat and flame fire (1) would or (2) would not reduce the potential for future large, intense fires.

	Years In Tucson			Age			Education		
Response	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
Would	76	74	75	**80**	72	73	68	**80**	79
Would Not	10	10	11	10	11	10	13	7	10
Don't Know	14	16	14	10	17	17	**19**	13	11
(Respondents)		(1197)			(1197)			(1187)	

	Annual Total Family Income					Sex	
Response	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
Would	67	71	78	81	71	**80**	**70**
Would Not	11	13	9	9	11	9	11
Don't Know	22	16	13	10	18	11	**19**
(Respondents)			(1042)			(1196)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 57. Percentage of respondents in each socioeconomic category who thought that a low heat and flame fire (1) would or (2) would not control the amounts of brush and shrubs.

	Years In Tucson			Age			Education		
Response	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Would	88	86	86	88	90	82	80	90	91
Would Not	3	7	7	5	4	8	8	4	4
Don't Know	9	7	7	7	6	10	12	6	5
(Respondents)		(1196)			(1196)			(1187)	

	Annual Total Family Income					Sex	
Response	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Would	88	84	87	93	82	89	84
Would Not	8	6	7	3	10	6	5
Don't Know	4	10	6	4	8	5	11
(Respondents)			(1042)			(1195)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 58. Percentage of respondents in each socioeconomic category who thought that a low heat and flame fire (1) would or (2) would not increase water supplies.

	Years In Tucson			Age			Education		
Response	**<5**	**6–11**	**>11**	**<30**	**30–50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Would	21	23	22	**23**	**18**	**24**	20	22	24
Would Not	42	39	41	**44**	**38**	**41**	41	41	42
Don't Know	37	38	37	**33**	**44**	**35**	39	37	34
(Respondents)		(1196)			(1196)			(1188)	

	Annual Total Family Income					Sex	
Response	**<5K**	**5–15K**	**15–25K**	**25–50K**	**>50K**	**Male**	**Female**
Would	21	22	22	24	31	**27**	**17**
Would Not	38	42	41	39	36	44	**38**
Don't Know	41	36	37	37	33	**29**	**45**
(Respondents)			(1042)			(1195)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 59. Percentage of respondents in each socioeconomic category who thought that a low heat and flame fire (1) would or (2) would not increase grazing areas.

	Years In Tucson			Age			Education		
Response	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
Would	50	55	50	**44**	**52**	**57**	48	50	55
Would Not	28	27	26	**36**	**25**	**20**	27	30	26
Don't Know	22	18	24	**20**	**23**	**23**	25	20	19
(Respondents)		(1196)			(1196)			(1188)	

	Annual Total Family Income					Sex	
Response	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
Would	51	48	51	57	59	**58**	**44**
Would Not	26	27	28	26	25	**27**	**27**
Don't Know	23	25	21	17	16	**15**	**29**
(Respondents)			(1042)				(1195)

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 60. Percentage of respondents in each socioeconomic category who thought that a low heat and flame fire (1) would or (2) would not reduce dead, woody material on the ground.

	Years In Tucson			Age			Education		
Response	<5	6–11	>11	<30	30–50	>50	HS Grad	Some Col	Col Grad
Would	90	89	89	**90**	**92**	**87**	**86**	**92**	**91**
Would Not	5	7	5	6	4	6	7	4	4
Don't Know	5	4	6	4	4	7	7	4	5
(Respondents)		(1196)			(1196)			(1188)	

	Annual Total Family Income					Sex	
Response	<5K	5–15K	15–25K	25–50K	>50K	Male	Female
Would	87	89	91	92	88	91	88
Would Not	9	6	6	3	7	5	5
Don't Know	4	5	3	5	5	4	7
(Respondents)			(1042)			(1195)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 61. Percentage of respondents in each socioeconomic category who thought that a low heat and flame fire (1) would or (2) would not control forest insects and diseases.

	Years In Tucson			Age			Education		
Response	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Would	58	59	60	**63**	59	**55**	56	61	59
Would Not	15	18	16	**18**	15	**15**	18	16	15
Don't Know	27	23	24	**19**	**26**	**30**	26	23	26
(Respondents)		(1197)			(1197)			(1187)	

	Annual Total Family Income					Sex	
Response	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Would	61	61	62	58	64	**63**	**55**
Would Not	13	14	14	19	16	**17**	**15**
Don't Know	26	25	24	23	20	**20**	**30**
(Respondents)			(1042)			(1196)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

that higher education attainment reflects a better understanding and increased knowledge about the role of fire in natural ecosystems.

The only statement which showed a significant difference for annual total family income was related to the control of brush and shrubs (Table 57). Examination of the response percentages indicates a substantial change between the 93% in the $25,000 to $50,000 bracket who answered the statement with "would" and the 82% in the over $50,000 group who gave the same response. The reason for this large degree of variation is not yet known.

The overall results from this question indicate that the general public is quite perceptive in recognizing the possible benefits of a low heat and flame fire. Survey participants appeared to be quite capable of identifying the three statements most commonly associated as benefits in prescribed fire programs. These statements were also consistent with the respondent-identified fire benefits elicited in Question 16. The three primary benefits identified in both questions were clearing debris, clearing undergrowth, and reducing fire danger. This area would appear to have a high potential for an educational effort or program.

Question 23.

At this point in the survey, after the participant had responded to several questions which dealt with the variability in fire intensities and subsequent effects, he or she was again asked if they approved or disapproved the use of prescribed fire or controlled burning. The results, shown in Table 62, indicate that three out of four respondents approved of prescribed fire. Of the 1200 participants just over 11% were not in favor of the use of prescribed fire, while 13% offered a "don't know" response. These results would indicate that the general public is willing to accept

Table 62. Number and percent of 1200 respondents who (1) approved or (2) disapproved of the use of prescribed fire or controlled burning.

ANSWER	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Approve	904	75.3
Disapprove	135	11.3
Don't Know	161	13.4
Total	1200	100.0

the use of prescribed fire as a viable and, indeed, an important resource management alternative.

In comparison, these results are not very different from those obtained to a similar question earlier in the survey. Question 17 had asked the 1011 respondents who had heard of prescribed fire whether they approved or disapproved of the practice. Those results, presented in Table 34, also showed a large percentage (80.1%) of "approved" responses. However, the 189 individuals in Question 17 who had not previously heard of prescribed fire were asked to offer an opinion on prescribed fire in Question 23, which may help to account for what variation exists in the responses to the two questions.

The socioeconomic cross-tabulations for this first part of Question 23 indicate significant differences for all five categories (Table 63). If an attempt was made to stereotype the person most likely to approve the use of prescribed fire, that individual would be a male, over 30 years of age, with an annual family income of $25,000 to $50,000, who had lived in Tucson over 5 years, and had some college education. Less acceptance of prescribed fire is shown by women, those who are less than 30 years of age,

Table 63. Percentage of respondents in each socioeconomic category who (1) approved or (2) disapproved of the use of prescribed fire or controlled burning.

	Years In Tucson			Age			Education		
Response	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Approve	69	77	79	71	78	77	69	**80**	76
Disapprove	13	12	10	16	10	8	15	10	9
Don't Know	18	11	11	13	12	15	16	10	15
(Respondents)		(1197)			(1197)			(1189)	

	Annual Total Family Income					Sex	
Response	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Approve	60	73	77	84	77	**81**	69
Disapprove	14	14	11	7	15	11	11
Don't Know	26	13	12	9	8	8	20
(Respondents)			(1042)				(1196)

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

individuals with only high school educations, and those with very low annual family incomes. Conservatism, a lack of knowledge or experience, or even apathy, may be partially responsible for these differences.

To determine why the 135 respondents who disapproved of the use of prescribed fire answered as they did, each of these individuals was asked to explain their response. As shown in Table 64, the four principal reasons why these participants still disapproved the use of prescribed fire were a fear that the fires would get out of control and become dangerous,

Table 64. For those 135 respondents who disapproved of the use of prescribed fire or controlled burning, the percent distribution of initial and 2nd responses by categories when asked to explain why they disapproved.

RESPONSE CATEGORIES	INITIAL RESPONSE	SECOND RESPONSE
1. Fires get out of control and become dangerous.	37.0%	3.7%
2. Fires cause damage to natural systems.	18.5	5.2
3. Categorical exclusion of fire for any reason.	23.7	3.0
4. Lack of knowledge, natural system too complex, leave nature alone.	15.6	0.7
5. Other.	4.5	0.7
6. Don't Know.	0.7	0.0
7. No response.	0.0	86.7
Total	100.0%	100.0%

that the fires would damage the natural ecosystem, that there was a lack of knowledge of fire effects in the complex system of nature, or, simply, the categorical exclusion of fire in the forest for any reason. Although there will always be some individuals who will oppose the use of prescribed fire under any circumstances, an informative and well-organized publicity program on the benefits of properly applied prescribed fire by an agency may help to alleviate some of the fears expressed in this question.

In a further breakdown of the initial responses to Question 23, the 904 respondents who had indicated their approval of the use of prescribed fire were asked if they would still approve this use of fire knowing that an occasional fire deliberately set by forest managers may get out of control. Over 70%, or 653 of the 904 participants, indicated that they would still approve the use of prescribed fire knowing that escapes were possible (Table 65). This information is of particular importance to the resource professionals contemplating the use of prescribed fire, since it indicates an especially high degree of tolerance and understanding of the unpredictability of fire in forests by the general public.

In an attempt to define this level of tolerance, those 653 participants who had still approved the use of prescribed fire with possible escapes were asked if they would continue to approve if 1 in 10 fires escaped. Quite surprisingly, 353, or nearly 30% of the total 1200 sample population, responded that they would still approve the use of fire even if 10% escaped (Table 66 (a)). The 242 respondents who could not accept the probability of 1 in 10 fires escaping and the 58 who offered a "don't know" answer were then asked if they would approve the use of prescribed fire if only 1 in 100 escaped. These results, plus those for a

Table 65. For those 904 respondents who approved of the use of prescribed fire or controlled burning, the number and percent who answered (1) yes (2) no or (3) don't know when asked that knowing an occasional fire deliberately set by forest managers may get out of control, if they would still approve this use of fire.

RESPONSE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	653	72.2
No	213	23.6
Don't Know	38	4.2
Total	904	100.0

further iteration to a 1 in 1,000 escaped fire probability, are presented in Table 66 (b) and (c).

When the 353 individuals who still approved the use of fire with a 1 in 10 escape probability are combined with the 210 who would accept 1 escape in 100 fires, there is a clear indication that the general public is willing to accept a fairly high percentage of escapes in order to achieve the benefits of prescribed fire.

In a further analysis, those 251 individuals who did not approve or did not know whether they approved the use of prescribed fire if an occasional fire were to get out of control (Table 65) were asked if they would approve if only 1 in 1,000 of these fires escaped. As the results in Table 67 (a) show, 121 of these 251 participants indicated that they would, in fact, approve of the use of prescribed fire if only 1 in a 1,000 of the fires escaped. In contrast, 117 individuals felt that even 1 escaped fire in 1,000 was not acceptable. Those 134 that approved or did not know whether they approved 1 escape in a 1,000 were then asked if they would approve if only 1 in 100 fires escaped. These results and those for a probability of 1 in 10 fires escaped are presented in Table 67 (b) and (c).

Table 66 (a). The number and percent of (1) yes (2) no or (3) don't know responses from the 653 participants who answered "yes" in Table 65 were further asked if they would still approve if 1 in 10 fires escaped.

RESPONSES	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	353	54.0
No	242	37.1
Don't Know	58	8.9
Total	653	100.0

(b). The number and percent of (1) yes (2) no or (3) don't know responses from the 300 participants who answered "no" or "don't know" in Table 66 (a) above were further asked if they would still approve if 1 in 100 fires escaped.

RESPONSES	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	210	70.0
No	60	20.0
Don't Know	30	10.0
Total	300	100.0

(c). The number and percent of (1) yes (2) no or (3) don't know responses from the 90 participants who answered "no" or "don't know" in Table 66 (b) above were further asked if they would still approve if 1 in 1,000 fires escaped.

RESPONSES	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	54	60.0
No	17	18.9
Don't Know	19	21.1
Total	90	100.0

Table 67 (a). The number and percent of (1) yes (2) no or (3) don't know responses from the 251 participants who answered "no" or "don't know" in Table 65 were further asked if they would approve if 1 in 1,000 fires escaped.

RESPONSES	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	121	48.2
No	117	46.6
Don't Know	13	5.2
Total	251	100.0

(b). The number and percent of (1) yes (2) no or (3) don't know responses from the 134 participants who answered "yes" or "don't know" in Table 67 (a) above were further asked if they would approve if 1 in 100 fires escaped.

RESPONSES	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	25	18.7
No	82	61.2
Don't Know	27	20.1
Total	134	100.0

(c). The number and percent of (1) yes (2) no or (3) don't know responses from the 52 participants who answered "yes" or "don't know" in Table 67 (b) above were further asked if they would approve if 1 in 10 fires escaped.

RESPONSES	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	8	15.4
No	29	55.8
Don't Know	15	28.8
Total	52	100.0

Although it is somewhat difficult to accurately determine the limits to which the general public will tolerate escaped prescribed fires, it is quite evident from these results that the public tolerance level is quite high. This may be due to the excellent record being established by professional foresters in not allowing many prescribed fires to escape. As the use of prescribed fire and the desire to expand prescriptions to allow more acreages to be burned continue to increase, more escapes are possible. If this were to happen, the general public could be expected to react with understanding and tolerance.

Question 24.

To determine the degree of awareness which Tucson residents have for the occurrence of fires in the nearby forests, each survey participant was asked if, to his or her knowledge, there had been any controlled burns or forest fires in the mountains around Tucson in the past year. Forty-six percent, or 552, of the respondents answered that they knew of such fires, while 228, or 19%, had no such knowledge (Table 68). A substantial 35% admitted that they did not know whether any fires had occurred.

In actuality, in examining the fire records of the Santa Catalina Ranger District for the 12 months immediately preceding the Tucson survey, 59 fires occurred which required some type of suppression activity. Of this number 43 were less than one-quarter acre in size, 15 ranged from 1/4 to 10 acres, and the largest was recorded as only 12 acres. During the 5-year period from 1977 to 1981, an average of 65 fires caused by lightning or human activity occurred annually on the District. The Jesus Fire, the largest in this time interval, burned 2,470 acres in mid-June of 1979. That particular fire occurred on the lower northwest slopes of the Santa Catalina mountains and was largely obscured from view in Tucson.

Table 68. Number and percent of respondents who answered (1) yes or (2) no when asked if they had knowledge of any controlled burns or forest fires in the mountains around Tucson in the past year.

RESPONSE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	552	46.0
No	228	19.0
Don't Know	420	35.0
Total	1200	100.0

Obviously, many of the fires which do occur are small in size and are quickly extinguished during the fire season. Since little publicity is generated and few of these fires are visible from the Tucson metropolitan area, it is understandable that the general public is not aware of the actual frequency of fires in the surrounding mountains. Although fire records for the same period from the Saguaro National Monument east of Tucson were not requested, it is safe to assume that lightning-caused fires did occur within the monument's boundaries.

An analysis of the cross-tabulations of socioeconomic categories for this question reveal that all five categories show significant differences at the 5% level of probability (Table 69). Respondents who had lived less than five years in Tucson and those with annual total family incomes of less than $5,000 offered significantly more "don't know" answers and fewer "yes" or "no" responses. Residents of less than five years could be expected to be less conscious of forest fire activity in the Tucson area than those with longer tenure. In addition, the lower income group may be largely comprised of University students who are short-term or temporary Tucson residents. Younger respondents, particularly those under 30 years

Table 69. Percentage of respondents in each socioeconomic category who answered (1) yes or (2) no when asked if they had knowledge of any controlled burns o forest fires in the mountains around Tucson in the past year.

	Years In Tucson			Age			Education		
Response	**<5**	**6-11**	**>11**	**<30**	**30-50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
Yes	30	52	55	41	51	47	41	48	50
No	20	21	17	24	16	17	24	18	15
Don't Know	50	27	28	35	33	36	35	34	35
(Respondents)		(1199)			(1199)			(1188)	

	Annual Total Family Income					Sex	
Response	**<5K**	**5-15K**	**15-25K**	**25-50K**	**>50K**	**Male**	**Female**
Yes	28	43	43	57	52	54	38
No	24	20	22	13	16	19	19
Don't Know	48	37	35	30	32	27	43
(Respondents)			(1043)			(1198)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

of age, also were less aware of the occurrence of forest fires in the surrounding mountains. The significant differences in responses for males and females noted throughout the survey are also evident for this question. A higher percentage of males than females indicated that they had knowledge of controlled burns or forest fires in the mountains near Tucson during the past year.

As a further extension of Question 24, the 552 respondents who stated that they knew of fires in the past year were asked how many fires they thought there had been. The response categories offered were 1 to 5, 6 to 10, 11 to 15, or more than 15 fires. Just over 50% of these 552 individuals indicated that they thought 1 to 5 fires had occurred (Table 70). Considerable uncertainty of actual fire numbers was evident from the high percentage of "don't know" responses.

The percent distribution of these responses by socioeconomic categories shows no significant differences for four of the five categories (Table 71). Those participants who had completed a college degree selected

Table 70. For those 552 respondents who had knowledge of any controlled burns or forest fires in the mountains around Tucson in the past years, the number and percent who thought that there were (1) 1 to 5 (2) 6 to 10 (3) 11 to 15 or (4) 16 or more fires.

FIRES	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
1 to 5	278	50.4
6 to 10	80	14.5
11 to 15	20	3.6
16 or more	31	5.6
Don't Know	143	25.9
Total	552	100.0

Table 71. For those 552 respondents who had knowledge of any controlled burns or forest fires in the mountains around Tucson in the past year, the percentage in each socioeconomic category who thought that there were (1) 1 to 5 (2) 6 to 10 (3) 11 to 15 or (4) 16 or more fires.

	Years In Tucson			Age			Education		
Fires	**<5**	**6-11**	**>11**	**<30**	**30-50**	**>50**	**HS Grad**	**Some Col**	**Col Grad**
1 to 5	57	51	48	53	51	48	**51**	**56**	**44**
6 to 10	16	19	13	18	12	14	**14**	15	15
11 to 15	3	3	4	4	3	4	**2**	5	4
16 or more	2	6	7	6	5	7	**3**	5	**9**
Don't Know	22	21	28	19	29	27	**30**	**19**	**28**
(Respondents)		(549)			(549)			(544)	

	Annual Total Family Income					Sex	
Fires	**<5K**	**5-15K**	**15-25K**	**25-50K**	**>50K**	**Male**	**Female**
1 to 5	45	55	60	48	38	51	51
6 to 10	18	13	15	13	9	15	13
11 to 15	5	3	3	5	6	5	2
16 or more	5	3	6	7	6	6	5
Don't Know	27	26	16	27	41	23	29
(Respondents)			(480)			(548)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

the "over 15 fires" response option more frequently (9%) than did those from the other educational levels. Conversely, these college graduates also had a lower percentage of responses for 1 to 5 fires. It may be speculated that higher educational achievements are associated with a greater breadth of interest and subsequent knowledge of activities taking place in nearby forest areas.

In an overall evaluation of the responses to this question, it appears that the general public is not totally aware of the frequency of fire occurrences in the mountains around Tucson. Even those individuals who know that fires do occur are not likely to recognize the numbers involved. As already mentioned, this lack of knowledge may be largely explained by the speed of suppression action and the absence of publicity with which resource management agencies handle many small fires during the fire season. The occasional lightning or man-caused fire which requires additional manpower, aerial support, and ground equipment or is clearly visible from the Tucson area will, in all probability, be the one that receives the attention of the public.

Question 25.

In an attempt to determine the degree of participation in forest area activities by Tucson residents each participant was asked if he or she regularly takes part in such activities. The results of this question, presented in Table 72, indicate that a slight majority of the 1200 survey respondents do regularly participate in activities which take them into forest areas.

The response breakdown by socioeconomic categories reveals that age, education, family income and sex all possess significant differences (Table 73). Those individuals who are males less than 30 years of age, with some

Table 72. Number and percent of respondents who answered (1) yes or (2) no when asked if they regularly participate in activities that take them into forest areas.

RESPONSE	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS
Yes	635	52.9
No	565	47.1
Total	1200	100.0

college education and a moderate family income are most likely to utilize forest areas on a regular basis. A substantial change can be noted for those over 50 years of age where two-thirds of that age group did not regularly participate in forest area activities. It is probable that the higher altitudes and poorer road conditions discourage older citizens with medical difficulties and driving apprehensions from using some forest areas in the Tucson area.

The 635 respondents who indicated that they did participate regularly in activities which took them into forest areas, were further asked to identify the types of activities they did do. The three most frequently mentioned activities on the initial response were hiking, camping, and picnicking (Table 74). These three activities were also prominently mentioned in the second responses along with fishing. The facilities for camping and picnicking and trails for hiking are excellent in forest areas near Tucson, so the high level of participation in these activities is not unexpected. A wide variety of other activities were mentioned including rock climbing, mineral collecting, sight seeing, birdwatching, spelunking, four-wheeling, photography, and horseback riding.

Table 73. Percentage of respondents in each socioeconomic category who answered (1) yes or (2) no when asked if they regularly participate in activities that take them into forest areas.

	Years In Tucson			Age			Education		
Response	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Yes	54	50	54	67	59	34	48	60	52
No	46	50	46	33	41	66	52	40	48
(Respondents)		(1196)			(1196)			(1187)	

	Annual Total Family Income					Sex	
Response	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Yes	41	50	56	61	53	57	49
No	59	50	44	39	47	43	51
(Respondents)			(1043)			(1195)	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

Table 74. For those 635 respondents who indicated that they regularly participate in activities that take them into forest areas, the percent distribution of initial, 2nd, and 3rd responses by categories when asked what kinds of things they do.

RESPONSE CATEGORIES	INITIAL RESPONSE	SECOND RESPONSE	THIRD RESPONSE
1. Hiking	29.1%	17.0%	3.5%
2. Camping	28.3	14.5	4.6
3. Picnicking	12.8	11.2	3.9
4. Backpacking	3.0	1.6	1.1
5. Fishing	4.3	10.1	4.6
6. Hunting	7.9	4.7	1.7
7. Skiing	1.6	1.6	1.6
8. Home in forest area	2.2	0.2	0.5
9. Work in forest area	2.2	0.2	0.5
10. Other	8.6	6.5	6.5
11. No response	0.0	32.4	71.5
Total	100.0%	100.0%	100.0%

Question 26.

For the final fire question, each of the 1200 survey participants was told that a question asked very early in the survey would now be repeated. In actuality, this was an attempt to determine whether the information and education on fire effects and the use of prescribed fire in forests presented during the survey itself had any influence in changing people's minds regarding the role of fire. The question, which was a repeat of Question 8, asked what each respondent thought should be done about a fire that is burning only underbrush and debris in a pine forest - should the fire be allowed to burn or should it be put out?

The overall results shown in Table 75 depict the distribution of responses by number and percent for both Question 26 and Question 8. At the completion of the survey there was a substantial increase in the number of respondents who felt that underbrush debris fires in pine forests should be allowed to burn. Conversely, there were fewer respondents who thought that the fire should be put out or who indicated that they did not know how

Table 75. Number and percent of respondents who thought that a fire burning only underbrush and debris in a pine forest should (1) be allowed to burn or (2) be put out. Numbers in brackets are the responses to the same question asked earlier in the survey (Question #8 and Table 14).

OPTION	NUMBER OF RESPONDENTS	PERCENT OF RESPONDENTS	PERCENT INCREASE/ DECREASE
Allowed to Burn	569 [456]	47.4 [38.0]	+9.4
Put Out	481 [583]	40.1 [48.6]	-8.5
Don't Know	140 [156]	11.7 [13.0]	-1.3
No Response	10 [5]	0.8 [0.4]	+0.4
Total	1200 [1200]	100.0 [100.0]	

to respond. These data give a clear indication that the educational value of even a 12- to 15- minute telephone conversation cannot be overlooked.

The breakdown of responses by socioeconomic categories was also compared for the two questions to further define the sources of response change (Table 76). It is of interest to note that every subdivision in all five socioeconomic categories exhibited an increase in the percentage of "allowed to burn" responses and a decrease in the "put out" replies when the question was asked for the second time. The greatest percent increase for "allowed to burn" responses occurred in the over $50,000 annual family income category where a change from 37% to 54% took place. Other increases of over 10% in "allowed to burn" respqnses between the first and second time the question was asked occurred in the following groups: less than 5 (+ 11%) and 6 to 11 (+ 13%) years in Tucson, less than 30 years of age (+ 14%), some college education (+ 13%), an annual total family income of $15,000 to $25,000 (+ 12%) and $25,000 to $50,000 (+ 12%), and females (+12%). The largest percent decrease in the "put out" responses from Question 8 to Question 26 was 20% for the less than $5,000 annual family income group. Both females and those who were less than 30 years of age showed a 13% decrease in the number who thought the fire should be put out, while the some college and over $50,000 annual family income categories decreased by 12%.

It would appear, then, that the educational and informational benefits of the survey questionnaire are most effective for the more recent Tucson residents, individuals less than 30 years of age, those with some college education, those in the higher annual family income categories (over $50,000), and females. In many cases a decrease in the number of "don't know" responses from the earlier to the later question could be observed. This is also an indication that more of the respondents to Question 26 felt

Table 76. Percentage of respondents in each socioeconomic category who thought that a fire burning only underbrush and debris in a pine forest should (1) be allowed to burn or (2) be put out. Numbers in brackets are the percentages for the same question asked earlier in the survey (Question #8 and Table 15).

	Years In Tucson			Age			Education		
Option	<5	6-11	>11	<30	30-50	>50	HS Grad	Some Col	Col Grad
Allowed to Burn	45 [34]	48 [35]	50 [42]	45 [31]	50 [44]	49 [39]	**36** [29]	54 [41]	54 [46]
Put Out	42 [53]	39 [47]	40 [47]	45 [58]	38 [40]	38 [48]	52 [56]	**36** [48]	**32** [41]
Don't Know	13 [13]	13 [18]	10 [11]	10 [11]	12 [16]	13 [13]	12 [15]	10 [11]	14 [13]
(Respondents)	(1190) [1195]			(1190) [1195]			(1184) [1186]		

	Annual Total Family Income					Sex	
Option	<5K	5-15K	15-25K	25-50K	>50K	Male	Female
Allowed to Burn	**38** [28]	42 [35]	50 [38]	58 [46]	54 [37]	53 [45]	**43** [31]
Put Out	45 [65]	43 [49]	39 [50]	33 [39]	41 [53]	39 [44]	41 [54]
Don't Know	**17** [7]	15 [16]	11 [12]	9 [15]	5 [10]	8 [11]	**16** [15]
(Respondents)			(1038) [1040]			(1189) [1194]	

(Boldface numbers indicate significance at the 5% level with the Pearson Chi Square Test of cross-tabulation independence).

that they could offer an "allow to burn" or "put out" response than they had in Question 8. The one prominent exception to this statement is for the less than $5,000 annual family income group where the "don't know" responses increased from 7% to 17% between Question 8 and Question 26.

An important implication which can be drawn from the results just described is that the general public is willing to listen and evaluate information which concerns the management of natural resources. Definitive statements which describe or explain a natural phenomena or management activity in the forest could be used effectively to solicit the support and acceptance of the general public for agency programs. The public appears to have greater faith and trust in public land management policies when they are kept informed of the reasons for such management or policy decisions.

SUMMARY AND RECOMMENDATIONS

The Santa Catalina Ranger District of the Coronado National Forest (CNF) and the Rincon Mountain District of the Saguaro National Monument (SNM) are a major source of recreational opportunities for residents of Tucson, Arizona. Because of their close proximity to this metropolitan area, fire management activities occurring on these sites are highly visible to valley residents. This study has examined the past history of fire management in these two recreational areas, and has surveyed a random sample of 1200 Tucson residents to determine their knowledge of fire and fire effects and their support for various fire management policies and programs.

For the most part, forest resource managers have been cautious in introducing fire as a management tool. While the SNM introduced a fire program permitting natural fires to burn under prescribed conditions in 1971, the basic prescriptions were very conservative. It was another seven years before the CNF adopted a prescribed fire plan for the areas under its jurisdiction. One reason for the cautious approach forest managers have taken toward fire is their uncertainty about public acceptability.

However, both experience and current survey data demonstrate that, at least in the Tucson metropolitan area, considerable public support exists for the use of fire as a management tool in forest areas. The adult population of Tucson does not believe that all fires are bad, a finding that consistently runs throughout the survey's results. For example, over two-thirds of our 1200 respondents replied that they personally thought fires could have a beneficial effect on forests (Question 16). And of this percentage, over 80 percent identified--in an open-ended question--the benefits of fire as either clearing or thinning for better growth or clearing away underbrush and debris. Over two-thirds of the respondents

also indicated that forest managers should periodically burn underbrush and debris in a pine forest (Question 20), and over 57 percent agreed with the statement, "fires that are burning underbrush and debris, but not tall trees, should be allowed to burn as long as they're watched" (Question 18b).

Prescribed fire is also not a strange term to the Tucson public. Eighty-four percent of the residents polled by our survey had heard of the term (Question 17), and of this group 80 percent strongly approved of its use (Question 17a). Prescribed fires were defined by our respondents as fires which result in some removal of underbrush, debris, and small trees in a forest, are under control or supervision of some authority, and are confined to a limited area (Question 17b). Those most likely to approve of the use of prescribed fire (Question 23) are males, over 30 years of age, with an annual family income of $25-50,000, who have lived in the Tucson area over five years, and who have at least some college education.

Among those approving the use of prescribed fire, there was also willingness to tolerate the risk of some fires escaping; over 70 percent of those who approved of the use of prescribed fire also indicated that they would still approve such fires even knowing that escapes were possible (Question 23b). While fire management policies have been liberalized in the past few years, there are those in the professional forest community who believe that the agencies' fire policies may still be too conservative and that fire suppression activities may be too costly in relation to benefits received (Schweitzer et al. 1982). Further modification of fire suppression policies could no doubt be made in the Tucson area without arousing intense public opposition. While the risk of error will always be present--the Prescott, Arizona, fire in 1956, and fires in Idaho and

Michigan during 1979-80, are examples of the kinds of public issues that can be generated when fire management practices go awry--the public's acceptance of risk appears to be much higher than commonly thought.

Certainly the level of public support that exists in the Tucson area for fires that are started by forest resource managers or are closely supervised by them demonstrates that the Tucson public has confidence in the forest manager's use and application of fires in forests. This bodes well for the CNF and SNM's plans to revise and expand their basic fire management activities and to accelerate their use of fire as a management tool.

The fact that such a large segment of the Tucson populace is supportive of the use of prescribed fire is no doubt largely due to the success of existing public information and education programs. As our history of fire management in the Tucson area illustrates, fire management practices have received considerable television and newspaper coverage. Both the CNF and SNM place considerable importance on notifying the media when fires are planned or are visible to residents of the area. The nature of the fire is discussed and the management response is explained.

Since the Tucson public is generally well informed about the use and benefits of prescribed fire, there does not appear to be a pressing need to generate new, massive educational efforts in this regard. The current approach should, of course, be continued, and will probably need to be expanded somewhat as the use of prescribed fire activities accelerates. Other areas of the country which have not publicized their fire management practices as actively as the CNF and SNM might also well be advised to follow this example.

While we found surprisingly high levels of support for fire management activities, we also found that the general public in the Tucson area is not

very familiar with the principal causes, normal intensities, and average acreage burned by most fires in pine forests (Questions 4-7). In addition, most respondents were also uninformed about the effects of fires on animals or how soon vegetation would be established after a fire (Questions 10,13). Yet, while considerable misinformation exists, most Tucson residents perceive themselves to be more informed than they actually are (Question 15), 44% rated themselves as above average in knowledge of fire effects. This is not surprising, for most people, including experts, routinely tend to be overconfident in their judgments and in the correctness of their estimates (Solvic et al. 1980, pp. 185-188; Kahneman et al. 1982).

Given the misinformation that exists in regard to fire and fire effects, we explored further the relationship between education, fire knowledge and support for fire management activities. Sixteen discrete items, (Questions 4-7, 9-13, 19, and 22a-f) elicited respondents' actual knowledge levels of fire effects. This tabulation deals with general fire knowledge, not with specific effects of prescribed burning. Of these sixteen items, eleven showed significant response differences based on education level, consistently in the direction of the more educated showing greater percentages of correct responses. In addition, two other items (Question 6 and 22d) showed the same trend, although not significant at the 5 percent level.

Similarly, a strong correlation was demonstrated between education level and attitude towards fire, in general a greater tolerance of less-than-severe fire. Of the nine discrete items (Questions 8, 18a-e, 20, 23, and 26) eliciting fire attitude or tolerance, seven showed significant differences by education level.

This dual correlation between education and fire knowledge and tolerance substantiates Stankey's (1976) findings that a significant

relationship exists between fire knowledge and tolerance of fire in forest ecosystems. This relationship has been further verified by the work of Taylor and Daniel (1982). These researchers provided fire effects information to their project participants, and found generalized increases in both knowledge and tolerance. The relationship between knowledge and attitude was firm in Stankey's research, Taylor and Daniel's study, and is reinforced by the results of the present survey.

Such a finding is not unexpected, for the more one knows about a specific occurrence, such as light fire, the more likely one is to be tolerant of it—especially if increased knowledge shows it to be not as bad as had been thought. This substantiated finding also strongly suggests that Stankey is correct in his assertion that "garnering public support for modified (fire) suppression policies seems closely linked to educating the public to the role of fire in forest ecosystems."

Since our questionnaire was specifically designed to account for the educational effects of the survey itself, we were able to demonstrate the educational effect that only a few minutes exposure to new fire information could have. We twice asked our respondents, for example: what "should be done about a fire that is burning only underbrush in a pine forest?" (Question 8 and 26). There was a 9.4% increase in the number of respondents who expressed the opinion that such fires should be allowed to burn from the time we first asked the question to when we repeated it at the end of the survey. Between Questions 8 and 26 there were numerous questions that were educational in context. We also found that while initial images of forest fires conjured up terms like "desolation," "mess," "destruction," "fast flames," "wall of fire," and "blazing" (Question 3), respondents were also able to relate quite readily to images of a less intense, less spectacular type of fire, and to recognize the

ecological benefits those fires can have. These findings again indicate the significant impact of education on changing public attitudes in regard to fire. Considerable education can occur in a short period of time if it is targeted to those items that are of most salient concern to the public. Relatively brief coverage on a radio or TV spot can probably be quite effective. As Rauw's (1980) experiment in the Olympic National Park demonstrated, interpretative exhibits or organized campfire meetings provide additional opportunities to present educational information. The degree to which such educational programs are needed, however, may not be quite as great as one might think, for as we have already demonstrated, the use of prescribed fire is generally appreciated and approved by the general public.

What educational programs designed to correct misinformation may do, however, is increase to a greater extent the level of support for fire as a management tool. The general public is receptive to—and further education is likely to reformulate their thinking in the direction of increased approval for--the careful application of fire management practices. Our data show several areas which managers might want to target with such educational efforts.

First, it was apparent from our results that the public places a high level of importance on wildlife in forest areas, and is quite concerned about any activity that would adversely harm wildlife or wildlife feeding areas (Questions 2, 3, 10, 14). Therefore, one area that could be targeted for further education is the relationship between wildlife and fire. If the public could see that animals are seldom hurt nor is their food supply destroyed during a low intensity fire, a great deal of their concerns might be alleviated.

One significant finding of the present study is that females are consistently more conservative and less likely to tolerate changes in forest ecosystems than are males. Given the considerable differences between males and females in terms of knowledge of fire and fire effects, and support for prescribed fire programs, a possible target area would be the preparation of educational materials that would reach adult female audiences.

Another area to emphasize would be pragmatic evaluations of the arguments used by those who disapproved of prescribed burning. Among those respondents who disapproved of this management practice, four principal reasons were apparent: (1) a fear that fires would get out of control and become dangerous; (2) a concern that fires cause damage to natural systems; (3) a belief that natural systems are too complex and should be best left to nature; and (4) the belief that fires should not be allowed in a forest for any reason (Question 23). If further public education is deemed desirable, these issues will need to be addressed.

While an informative and well-organized publicity project on the benefits of properly applied prescribed fire could do much to overcome some of the above objections, Taylor and Daniel (1982) offer some words of caution that pertain to public information programs. They discovered that although information brochures did increase fire knowledge and tolerance, these educational instruments did not affect perceptions of scenic beauty or recreational acceptability in burned areas. They suggest that such affective responses may be less susceptible to change than cognitive responses of fire knowledge and attitude. Whether more forceful or prolonged educational programs could effectively alter affective responses to burn areas is an open question, and one that deserves serious consideration.

We also caution about the danger of generalizing from our data. Our survey was specific to fire management in recreational areas near Tucson. Whether residents of brush fire-prone regions of southern California or timber-rich western Oregon would respond in the same manner as our residents needs to be considered, and should be empirically tested. Location may be an important variable, but could not be taken into account in the present survey.

In sum, Tucsonans place a high value on the recreational benefits of forest areas, with a majority reporting that they regularly take part in the kinds of recreational activities that take them into such areas (Question 25). They also recognize that fire can play a dual role--one beneficial and one detrimental. Public acceptance and understanding of the purposes and benefits of fire as a management tool are high. Barring the development of some unforeseen controversy, the opportunities for policy innovation are significant. Public education could expand the existing level of support for these policy developments, and increase the public's awareness and understanding of the significance of these changes for management of local forest recreational lands. To be most effective, such public education should probably be geared to local forest and range conditions as well as to measured levels of local knowledge and acceptance of fire management practices.

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APPENDIX A

FIRE SURVEY

Hello, my name is _____ and I'm calling for the College of Agriculture at the University of Arizona. We're conducting about a 15-minute survey on people's attitudes toward forest areas like those on Mt. Lemmon and in the White Mountains. (IF NECESSARY, CHECK TO BE SURE THE PERSON IS 18 OR OLDER, AND, IF HE ISN'T, ASK TO TALK TO AN OLDER PERSON.)

1. We'd like to start out with a general question on forests. People feel differently about the importance of forest areas. In comparison with other resources, how important do you yourself think forest areas are — would you say they're not very important, somewhat important, or very important?

   __1. NOT VERY __2. SOMEWHAT __3. VERY __4. DK

2. Now, as I read a list of specific things that forest areas can provide, please tell me how important each thing is to you personally. On this question, I would like you to use a 0 to 10 scale, where 0 is not at all important and 10 is extremely important. You can give any number between 0 and 10 or simply say you don't know. How about . .

   a. Providing firewood ___
   b. Providing protection for water supplies ___
   c. Providing food for livestock ___
   d. Providing food for wildlife ___
   e. Providing opportunities for outdoor recreation, such as picnicking, camping, and hiking ___
   f. Providing opportunities for hunting ___
   g. Providing lumber and other wood products ___

Now we would like to ask some questions about fires in ponderosa pine forests, like those on Mt. Lemmon and in the White Mountains.

3. What comes to mind when you think of a fire in a pine forest. Just imagine this kind of fire in your mind and tell me what you see. (PROBE UNTIL YOU'VE GOTTEN AS CLEAR AND COMPLETE A PICTURE AS YOU POSSIBLY CAN DRAW OUT OF THE RESPONDENT.)

_____

_____

_____

_____

_____

Now I want you to feel free to say you don't know on any of the questions I'll be asking.

4. What do you think starts most forest fires in pine forests — lightning, arson, or human carelessness?

   __1. LIGHTNING __2. ARSON __3. CARELESSNESS __4. DK

5. Compared to other sources of air pollution such as cars, factories, and unpaved roads, how much of a factor do you think forest fire smoke is in air pollution — not a factor, minor, moderate, or a major factor?

   __1. NOT __2. MINOR __3. MODERATE __4. MAJOR __5. DK

6. How intense do you think most forest fires are — not very hot with low flames, moderately hot with medium-size flames, or very hot with high flames?

   __1. NOT VERY HOT __2. MODERATELY HOT __3. VERY HOT __4. DK

7. How much area do you think most forest fires burn — less than 1 acre, between 1 and 100 acres, hundreds of acres, or thousands of acres?

   __1. LESS THAN 1 __2. 1-100 __3. 100's __4. 1,000's __5. DK

8. What do you think should be done about a fire that is burning only underbrush and debris in a pine forest — do you think it should be allowed to burn or be put out?

   __1. ALLOWED TO BURN __2. PUT OUT __3. DK

9. How do you think a fire that is burning only underbrush and debris would affect a pine forest — do you think it would make room and allow other trees to replace pines, or do you think it would help to keep the area a pine forest?

__1. ALLOW OTHER TREES TO REPLACE PINES __2. KEEP IT PINE __3. DK

For the next questions we want you to think in terms of a rapidly moving, intense forest fire.

10. How many animals do you think these kinds of forest fires kill — no animals, few, a moderate number, or lots of animals?

__1. NO __2. FEW __3. MODERATE __4. LOTS __5. DK

11. Compared to other water pollution sources such as sewage plants, industrial wastes, and urban run-off, how much of a factor do you think these kinds of forest fires are in water pollution — not a factor, minor, moderate, or a major factor?

__1. NOT __2. MINOR __3. MODERATE __4. MAJOR __5. DK

12. How much soil erosion do you think results from rapidly moving, intense forest fires — no erosion, minor, moderate, or severe erosion?

__1. NO __2. MINOR __3. MODERATE __4. SEVERE __5. DK

13. After these kinds of forest fires, how long do you think it usually is before the grasses and other vegetation begin to grow back — within 1 year, 1 to 3 years, 3 to 5 years, or never?

__1. WITHIN 1 YR. __2. 1-3 YRS. __3. 3-5 YRS. __4. NEVER __5. DK

14. Now a little different kind of question, and I want you to use the 0 to 10 scale again. If you were to see or know that there was a forest fire, how concerned would you personally be about each of the following things? 0 is <u>not at all</u> concerned and 10 is <u>extremely</u> concerned. How concerned would you be . . .

a. That wild animals will die ___
b. That livestock will lose their food supply ___
c. That wild animals will lose their food supply ___
d. That recreation areas will be destroyed ___
e. That future water runoff will cause erosion and mud slides ___
f. That smoke will pollute the air ___
g. That trees will be destroyed ___

15. Now I want to ask how much you feel you personally <u>know</u> about the effects of forest fires. Rate your knowledge of this area on the 0 to 10 scale where 0 is no knowledge.

___

16. Do you personally think fires ever have any beneficial effects on forests?

__1. YES __2. NO __3. DK
↓ (SKIP TO QUESTION 17)

16a. What do you think are the beneficial effects of fires on forests?

_____

_____

_____

_____

_____

17. Have you heard of prescribed fire, which is also called controlled burning?

__1. YES __2. NO __3. DK
(SKIP TO QUESTION 18)

17a. Do you approve or disapprove the use of prescribed fire, or controlled burning?

__1. APPROVE __2. DISAPPROVE __3. DK

17b. How would you define prescribed fire, or controlled burning?

_____

_____

_____

_____

18. Now I want you to tell me whether you strongly agree, agree, disagree, or strongly disagree with the following statements. The statements concern fires that allready are burning in pine forests.

a. Fires that allready are burning should be allowed to burn as long as they're watched. __1. SA __2. A __3. D __4. SD __5. DK

b. Fires that are burning underbrush and debris, but not the tall trees, should be allowed to burn as long as they're watched. __1. SA __2. A __3. D __4. SD __5. DK

c. Fires that were started by lightning should be allowed to burn as long as they're watched. __1. SA __2. A __3. D __4. SD __5. DK

d. Fires that were started by human carelessness should be allowed to burn as long as they're watched. __1. SA __2. A __3. D __4. SD __5. DK

e. No fires should be allowed to burn in pine forests. __1. SA __2. A __3. D __4. SD __5. DK

19. Do you agree or disagree with the following statement: Severe fires are less likely to occur in pine forests that have had occasional underbrush fires.

__1. AGREE __2. DISAGREE __3. DK

20. Do you think forest managers should or should not periodically burn underbrush and debris in pine forests?

__1. SHOULD __2. SHOULD NOT __3. DK

21. There are two extremes in forest fires. Some travel rapidly with a lot of intense heat and flame and burn everything, while others travel slowly with low heat and flame and burn only leaves, branches, and debris on the ground. Some forest managers claim that the low heat and flame fires can be beneficial while other forest managers say all fires are harmful. Have you heard of this issue?

__1. YES

21a. Is this issue important to you personally?

__1. YES __2. NO __3. DK
(SKIP TO QUESTION 22)

21b. On the 0 to 10 scale where 0 is not very important, how important is this issue to you personally?

_____
(SKIP TO QUESTION 22)

__2. NO __3. DK

21c. Even though you haven't heard about it, is the issue important to you personally?

__1. YES __2. NO __3. DK
(SKIP TO QUESTION 22)

21d. On the 0 to 10 scale where 0 is not very important, how important is this issue to you personally?

_____
(GO ON WITH QUESTION 22)

22. Please tell me whether you think a low heat and flame fire would or would not do the following things . . .

a. Reduce the potential for future large, intense fires	__1. WOULD	__2. NOT	__3. DK
b. Control amounts of brush and shrubs	__1. WOULD	__2. NOT	__3. DK
c. Increase water supplies	__1. WOULD	__2. NOT	__3. DK
d. Increase grazing areas	__1. WOULD	__2. NOT	__3. DK
e. Reduce dead, woody material on the ground	__1. WOULD	__2. NOT	__3. DK
f. Control forest insects and diseases	__1. WOULD	__2. NOT	__3. DK

23. Now that we've talked about different kinds of fires, I'd like to ask you (again): Do you approve or disapprove the use of prescribed fire, or controlled burning?

__1. APPROVE __2. DISAPPROVE __3. DK (SKIP TO QUESTION 24)

23a. Why do you disapprove?

_____

_____

_____

_____

(SKIP TO QUESTION 24)

23b. Knowing that an occasional fire deliberately set by forest managers may get out of control, would you still approve this use of fire?

__1. YES __2. NO __3. DK

23c. Would you still approve if 1 in 10 fires escaped?

__1. YES (SKIP TO Q. 24) __2. NO __3. DK

23d. Would you still approve if 1 in 100 escaped?

__1. YES (SKIP TO Q. 24) __2. NO __3. DK

23e. If 1 in 1,000 fires escaped, would you still approve?

__1. YES (SKIP TO QUESTION 24) __2. NO __3. DK

23f. Would you approve if 1 in 1,000 fires escaped?

__1. YES __2. NO (SKIP TO Q. 24) __3. DK

23g. Would you approve if 1 in 100 fires escaped?

__1. YES __2. NO (SKIP TO Q. 24) __3. DK

23h. Would you approve if 1 in 10 fires escaped?

__1. YES (GO ON WITH QUESTION 24) __2. NO __3. DK

24. To your knowledge have there been any controlled burns or forest fires in the mountains around Tucson in the past year?

__1. YES __2. NO (SKIP TO QUESTION 25) __3. DK

24a. How many fires do you think there have been?

__1. 1-5 __2. 6-10 __3. 11-15 __4. 16 OR MORE __5. DK

25. Do you regularly participate in activities that take you into forest areas?

__1. YES __2. NO (SKIP TO QUESTION 26)

25a. What kinds of things do you do in forest areas?

_____

_____

_____

26. Now I would like to repeat one of the first questions I asked: What do you think should be done about a fire that is burning only underbrush and debris in a pine forest — do you think it should be allowed to burn or be put out?

__1. ALLOWED TO BURN __2. PUT OUT __3. DK

27. How long have you been living in Tucson? __ MOS. (IF LESS THAN 1 YEAR)

__ YEARS

28. What is your age please? __ YEARS OLD

29. What is the highest grade or year of school you completed?

__1. LESS THAN HIGH SCHOOL
__2. HIGH SCHOOL GRAD
__3. TRADE OR BUSINESS SCHOOL
__4. SOME COLLEGE
__5. COLLEGE GRAD
__6. POST-GRADUATE WORK OR DEGREE

30. Which of the following income groups does your total family income for last year fit into — under $5,000 . . . $5,000 to $15,000 . . . $15,000 to $25,000 . . . $25,000 to $50,000 . . . or over $50,000?

__1. UNDER 5 __2. 5-15 __3. 15-25 __4. 25-50 __5. OVER 50

31. INDICATE SEX: __1. MALE __2. FEMALE

That completes the survey. Thank you very much for responding. Let me just check to be sure I dialed the correct phone number — is this (REPEAT PHONE NUMBER)? In case my supervisor wants to call and verify that I completed this interview with you, would you give me just your first name?

NAME OF RESPONDENT_____ PHONE NUMBER OF RESPONDENT_____

INTERVIEWER_____ DATE OF INTERVIEW_____

SAMPLE: __1. ORIGINAL __2. DISC. OR CHGD. # __3. REFUSAL __4. NA __5. LANG.

__6. OTHER (EXPLAIN) _____